DR. GORDON THOMPSON
2 East End Avenue
New York 21, N. Y.

August 1961

Insulation

Bouncing insulator . . . page 31

In this issue:

Electrical fish lure . . . page 8
Insulation education . . . pages 10 & 43
Water-soluble fluxes . . . page 22
Copper foil tape . . . page 28
What's new . . . page 46

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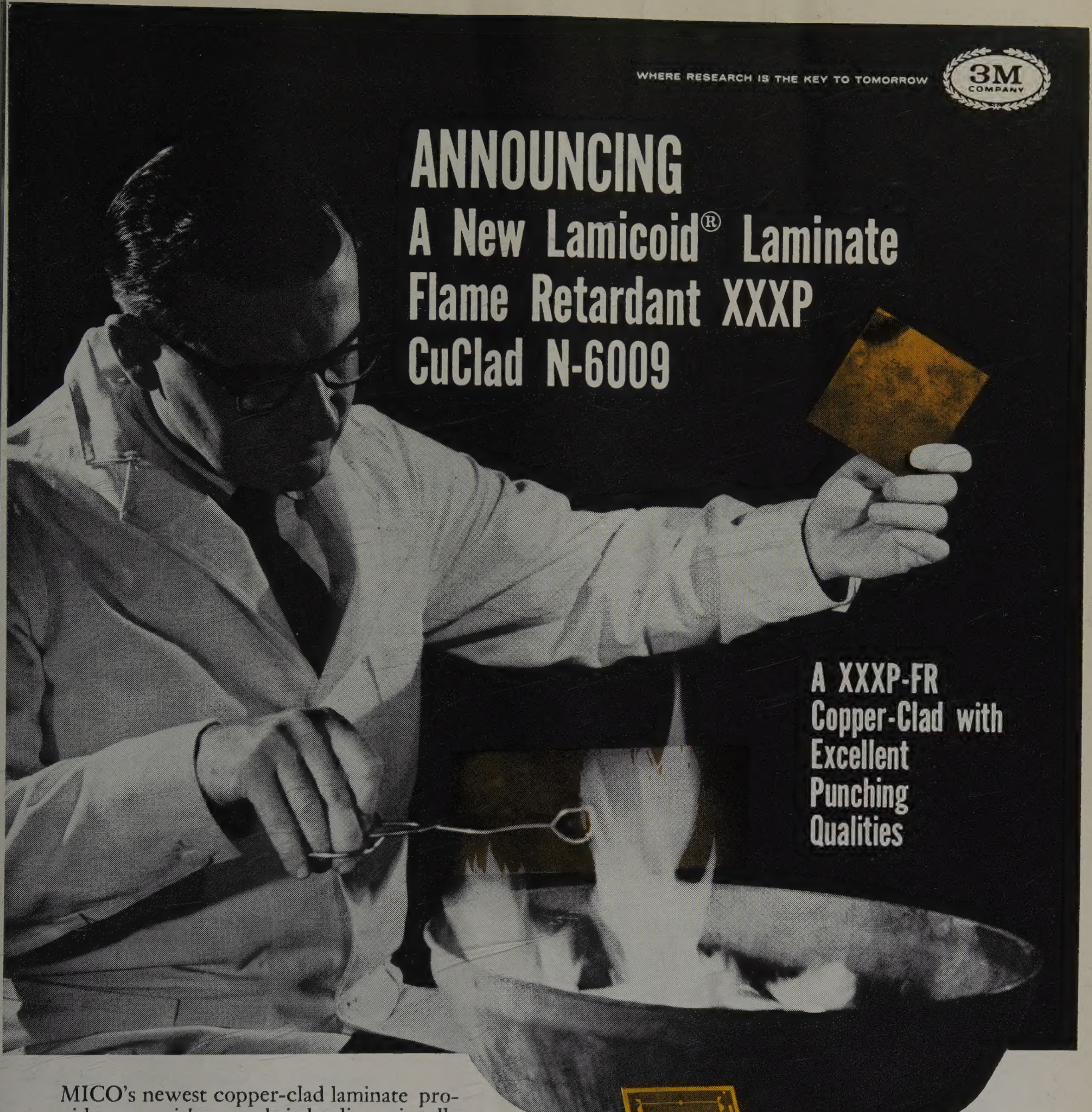

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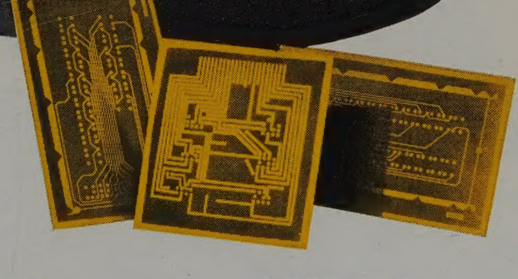

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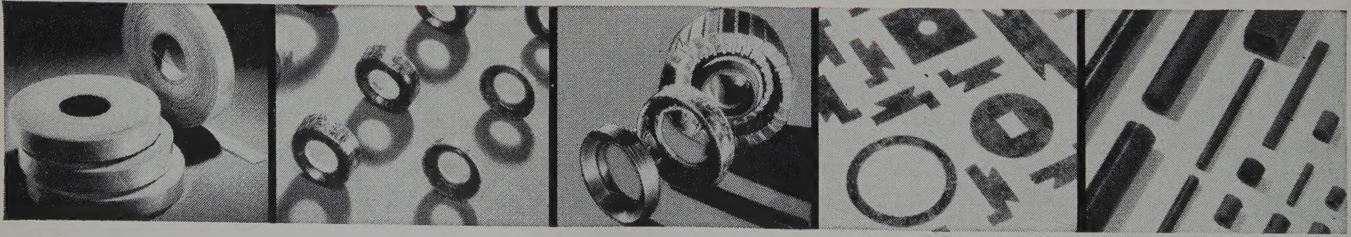

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Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Avenue, Libertyville, Illinois, August, 1961
Publishers of Insulation, Insulation Directory/Encyclopedia Issue, Plastics Design & Processing

14 Improved Process for Glass-to-Metal Seals

22 An Evaluation of Water-Soluble Fluxes—Part 1
F. Z. Keister

28 Copper Foil Tape Simplifies Printed Circuit Model Making for Microwave Components

31 Molded Polyester-Glass Permits New Insulation Performance Standards in Switchgear and Controllers
J. A. Marks

42 Terminal Board for Guidance Device Resists Heat and 30 G's

42 All Aluminum Transformer

42 Ceramic Capacitors Comparable to Paper and Film Units

43 Inductive Voltage Divider Calibration

4 From the Editor
6 News and Views
8 Pixilated Patents
10 Insulation Forum
16 European Insulation Report
38 Industry News
40 Association News
43 Letters to the Editor
44 People in the News
46 New Materials and Components
64 New Instruments and Equipment
67 New Literature
70 Dates to Circle
71 NEMA Electrical Insulation Index
72 Advertisers' Index

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Associate Editor: Richard D. Simonson
Production Manager: F. P. Mignin
Contributing Editors: Graham Lee Moses, H. K. Graves, Mike Rivise
Consulting Editor: George V. Michael
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Advertising Sales Offices: See page 72.

From the Editor

Opinions and Rambling Thoughts

More on Education

Of late, we've done quite a bit of discoursing on insulation education as evidenced by recent editorials and this month's forum question. This month, we'll leave insulation alone (at least on this page) to cover some of the broader aspects.

At the AIEE summer general meeting, Simpson Linke, associate professor of electrical engineering at Cornell University, made an excellent point when he stated that a re-evaluation of the goals of undergraduate electrical engineering education is needed to prevent 90 percent of the students from entering a "never-never" land of theory with the danger of becoming mathematical robots. He reported that the present emphasis on science and mathematics in electrical engineering curricula is creating a research-oriented type of undergraduate education that may lead to inadequate preparation for professional careers in engineering.

As pointed out by Prof. Linke, such education may make it possible for many non-research-minded graduates to become facile with differential equations but completely out of touch with the physical realities of engineering problems. We agree wholeheartedly with the thoughts of Prof. Linke. In recent years the pendulum has swung too far toward science for *all* students—an educational compromise is necessary for the many students who plan to be engineers rather than scientists. Otherwise, a considerable number of these graduates might turn out to be poor engineers or poor scientists . . . or even turn to other professions.

The suggestions of Prof. Linke do not have to mean any lessening of the training of scientific manpower—they merely mean that we should more realistically evaluate the purposes of our undergraduate educational programs in order to educate better engineers while still providing a firm foundation for those who wish to pursue graduate studies leading to research and scientific work.

The Future of Ceramics

As is true with many "old fashioned" materials, ceramics seemingly experienced a long period of relative inactivity and lack of research. However, it is encouraging to note that since shortly after the second world war, a great deal of progress has been made with ceramics especially for electrical/electronic insulation applications. Scientists have been re-examining ceramics and coming up with startling new developments both as to materials and techniques. Heat, of course, is a major reason for the surge of interest in ceramics. Their future is indeed bright—we personally expect to see ceramics which are nearly as versatile in their properties as some of the plastics of today.

A typical example pointing to the key role possibilities for ceramics is the recent work performed by Westinghouse Electric Corp. scientists on magnetohydrodynamic (MHD) generators. Ceramics have been shown to be the best substances so far discovered for holding in check the white-hot stream of gases from which electric power is obtained in MHD generators. They have permitted an experimental unit to operate continuously for up to 50 minutes in contrast to the usual operating period of only a few seconds.

In MHD generators, a moving stream of ionized conducting gas, called a plasma, as hot as 5000°F and with speeds up to 2000 miles per hour, replaces the moving copper conductors of a conventional generator. Ceramics are the first materials reported that hold up under such conditions for appreciable periods of time when used to line the walls that contain the white-hot stream. The insulating materials are needed to protect the generator walls from the hot gases and to keep the electrodes, located in the walls, from shorting out. So far, magnesium oxide has performed well and zirconium oxide has shown good endurance.

Foreign Competition

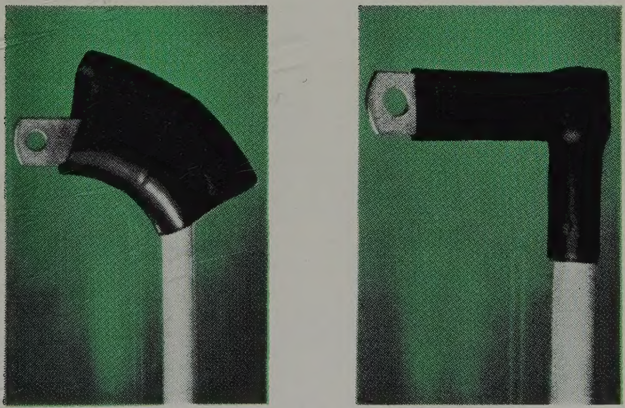
For some time the domestic electrical industry has suffered some significant sales losses due to foreign competition. The electronics industry is now beginning to also feel the effects of foreign trade. As always, there are two sides to the coin. Domestic manufacturers may claim that the lower wage rates in foreign countries represents unfair competition. In some few instances, design piracy might also be a factor which eliminates much research and development cost for foreign firms. On the other hand, foreign companies point out that the United States exports more than it imports which is not fair. In rebuttal to this, a domestic company can point to our balance of payments deficit, a substantial part of which is due to foreign aid in one form or another.

What's the answer? . . . there are many. And some of them are unpleasant to contemplate for both countries and companies alike, both foreign and domestic. For one thing, greater reciprocity in trade is needed on both sides. Also, greater investment freedom and opportunities are needed in many countries—too often, national pride prevents foreign investment. Wealth in other countries should not be so concentrated that standards of living (and wage rates) do not rise. As the economies of other countries improve, they must assume an increasing burden of the necessary aid to underdeveloped nations. In this country, the gains of higher productivity must be reflected in lower prices rather than in increased wages—the wage-price spiral must be stopped.

There are many other answers. Unfortunately, most of the answers are determined by governments rather than individual companies. We believe in a final solution of free competition . . . *on an equal basis.*

HEAT SHRINKABLE

FLAG BOOTS



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New Phenol Entry

Schenectady Varnish Co. Inc., Schenectady, N. Y., has announced that a full-scale phenol plant will be built at the firm's 56-acre waterfront site at Rotterdam Junction, N. Y. The new plant will mark the 55-year-old company's entry into basic raw-material production. Scheduled for completion early in 1962, the new operation is expected to strengthen Schenectady's position in their future production of synthetic resins for applications in electrical coatings, adhesives, laminates, paper, reinforced plastics, and other areas.

Price Reductions

Further welcome news for readers as announcements of price reductions on various materials continue to cross the editor's desk . . . on polyethylene, Hercules Powder Co. has cut the price of its 0.945 density resin from 38¢ to 35¢ per pound and has set a price of 32¢ per pound on its new 0.962 density stiffer resin. Reductions in the same amounts for similar grades have also been made by W. R. Grace & Co. Grace has also cut the price of wire and cable materials by 3¢ a pound and flame-retardant high density polyethylenes by 5¢ a pound (from 48 to 43¢).

The price of polypropylene film has been slashed to 64¢ per pound in all thicknesses in shipments of 500 pounds and more from previous prices of 70¢ for 10,000-pound quantities and 73¢ for the 300 to 2,999-pound bracket. Avisun Corp., in making the announcement, cites increased production as the reason.

Reductions of 11 to 40 percent on various polyester type resins and adhesives have been reported by the Du Pont Company's Fabrics and Finishes Department. The materials are used in a number of industries.

Prices on 100 percent virgin "Teflon" polytetrafluoroethylene rods have been reduced by Tri-Point Industries Inc.

The price of vinyl chloride monomer, most of which is used in making polyvinyl chloride resin, is being offered by many makers at a new low of 7½¢ per pound, down a penny from the previous price. The new low represents a drop of more than 30 percent from prices quoted earlier this year. PVC has been selling at 17½¢ a pound or lower. The price weakness which might be partially overcome later this year has been attributed to foreign and domestic competition, over-capacity, and loss of some markets to other plastics.

Allied to Produce Electrical Films

The General Chemical Division of Allied Chemical Corp. has acquired a plant site with buildings near Pottsville, Pa., for its first commercial plant to produce plastic films. Production is scheduled for the end of the year. Initial products to be made will be the new "Aclar" fluorohalocarbon and "Capran" polyamide films. The Aclar films are being recommended for electrical/electronic applications such as printed circuits, printed cables, electro-luminescent panels, and capacitor insulation.

Du Pont Looks to Commercial Production Of Heat Resistant ML Insulations

With a continuation of favorable field and laboratory experience for the Polymer ML family of electrical insulation materials, Du Pont Company is looking forward to larger scale commercial production. The ML insulation materials presently include wire enamels, coated fabrics, and varnishes. Developed by the Fabrics and Finishes Department, the insulations are reported to have an expected life of more than 10 years at 200°C, more than 2 years at 250°C, several months at 300°C, and shorter periods at 400 to 500°C.

Other properties claimed include excellent electrical characteristics which are stable from room temperature to 250°C, resistance when cured to all known solvents, no cut-through at 500°C for the wire enamel when subjected to standard tests, excellent radiation resistance, excellent moisture resistance, and no support of combustion when cured.

Considerable interest has already been generated in the ML magnet wire through fairly heavy promotional efforts by a number of the wire producers. The varnish is also available for experimental and commercial use. A four-mil coated fabric is expected to be available soon with other thicknesses under development.

Two Factors Will Improve Business

Look for two factors to result in improved business. First, large scale projects (government, industrial, and construction) have to move out of the discussion stage and into the active stage. Some such projects have been discussed and delayed for so long that they soon will have to move into more concrete phases because those involved are plain tired of merely talking about them. Secondly, business conditions will improve with greater price stability in some areas. Efforts are being made in this direction and you can look for them to multiply in coming months . . . which means in many cases that the time to buy is now. Severe price competition has hurt more than one industry—business has suffered even though sales were increased because of the lower profit margins. And the lower profit margins have frequently led to reduced research and product improvement activities which cannot continue because of the effect on the future. It all adds up to noticeable upswings in the business climate in the coming months.

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Stevens POLYGLAS* coating fabric provides voltage protection with *FEWER* and *THINNER LAYERS!* Thanks to Glass and Dacron® Polyester, Polyglas can be stretched to conform to intricate contours without opening or tearing, providing the smoothest base possible in woven insulation for cable overwrap. Dielectric properties actually increase after Polyglas coated tape is wound and stretched.

Polyglas is available as a base coating fabric in two-, three-, and four-mil thicknesses in lengths up to 1,500 yards per roll.

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Write or phone for suppliers of Polyglas coated fabric or tapes.

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Current Transformer (top), Power Distribution Bus (bottom) illustrating two of the many taping operations for Teraglas† made with Stevens new Polyglas fabric. †T.M. Natvar Corp.

J. P. Stevens & Co., Inc.

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Pixilated Patents

By Mike Rivise

Fifty-sixth in a series of odd and interesting inventions in the electronics field from the files of the U.S. Patent Office.

As August is traditionally vacation time, and consequently a time of fish tales, our patent this month concerns an improved method of catching fish which will fit right in with your favorite story about the one that got away. However, before you rush right out to try it, you better check your local fishing laws or you might land in jail . . . this improved method may be illegal in some areas.

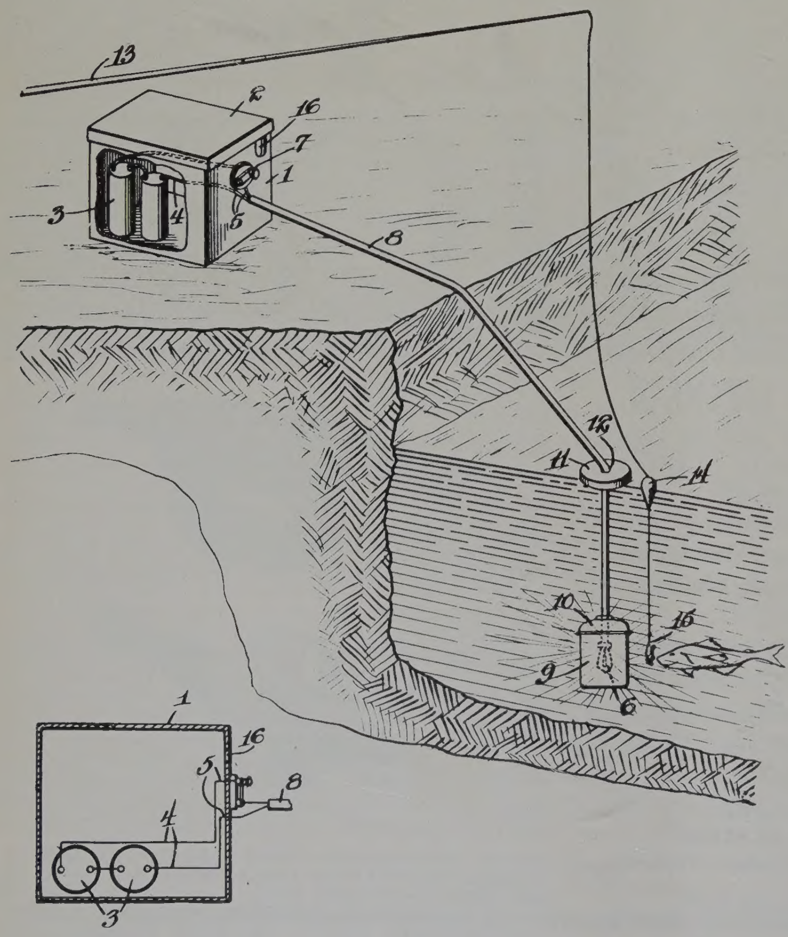
The apparatus was described by the inventor, William J. Ryan of Sapulpa, Okla., in patent 1,192,001 as "a luminous device to be used in connection with an ordinary hook and line for the purpose of attracting fish and causing them to come from under drifts and other hiding places to the open where they may be easily caught by the use of the hook and line."

Referring to the drawing, the patent describes the invention as follows: "numeral 1 designates a receptacle having a cover 2, which receptacle and cover are formed preferably of wood and in which receptacle are arranged batteries 3. The batteries are connected by means of wires 4, which extend through the openings 5, arranged in one of the sides of the receptacle and have connected on their outer ends a lamp 6. In order to control the passage of the current through the wires, I have secured to the outer surface of the receptacle adjacent one of the openings 5, a switch 7, and connected one of the wires thereto as clearly shown in the drawings.

"For the purpose of preventing the wires from having contact with the water in which the same in the lamp are adapted to be disposed for the purpose of attracting the fish, I have mounted about the same an elongated piece of rubber tubing 8, which extends from a point adjacent the switch 7 to the lamp 6. In order to protect the lamp 6, which is of very fragile material, I have mounted in close proximity to the same on the rubber tubing 8 a transparent protective casing which consists essentially of a glass jar 9 having a removable cover 10. The thickness of the glass of which the jar is formed is less likely to break when coming in contact with a small article or other debris than the glass of which the lamp is formed.

"For the purpose of holding the lamp and its protective casing at any desired depth in the water, I have slidably mounted about the tubing 8 a circular disk float 11, formed preferably of cork, by means of an opening 12 centrally disposed in the disk, the opening being arranged in close relation with the surface of the tubing for substantial frictional engagement therewith. It must be understood that the float is of sufficient diameter to withstand the weight of the lamp and its protective casing."

We especially enjoyed the smile on the fish in the drawing . . . he looks as if he is about to slip the bait off the well lighted hook.



Accurate RF Thermal Voltage Converters

Thermal voltage converters, each consisting of a deposited-carbon resistor in series with a thermoelement in a coaxial line, have recently been designed by the National Bureau of Standards. They are useful for measurements of rms voltages of 1 to 200 volts at frequencies from 3 cps to 30 Mc. By a-c—d-c transfer techniques, an accuracy of 0.1 percent or better may be obtained up to at least 10 Mc, and 0.2 percent at 30 Mc.

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Because of its flexibility, Aboglas is easy to handle, and its mechanical and electrical properties are excellent. Aboglas is being used here, not only to separate the end turns, but also as a separator between the top and bottom coils in the slot portion of the armature.

Aboglas easily adapts itself to the contour of a large armature. This ability to conform to irregular surfaces, plus high mechanical and electrical strength makes it popular for important rewind jobs.

West Virginia Armature Co., with main plant in Bluefield, and five branch plants in other important coal mining areas, has built an excellent reputation for Service since its founding in 1909.

This Company has been using Aboglas for some time as shown in the accompanying photos, and also as a separator between the shunt and series sections of compound field coils.

Aboglas, a composite consisting of a layer of varnish saturated asbestos paper sandwiched between two layers of varnished open-weave Fiberglas*, is only one of the Natvar insulations developed to do a specific job, and do it well. If you are using flexible electrical insulations, it will pay you to investigate the Natvar line. You can depend on their uniformly high quality, and you can get them either from your own wholesaler or direct from us.

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Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestion for future questions and participation are invited. This month's question is:

What are your thoughts regarding the type of educational program, if any, needed to provide the electrical/electronic insulation industry with qualified engineers and scientists and to provide those already in industry but new to the insulation field with an opportunity to acquire the necessary background in insulation?

M. A. Arthur

Research Specialist, Humble Oil & Refining Co., Houston, Texas.

"In view of the abundance of educated thoughts and replies which are being currently published on the broad question, I would prefer to recommend some of these to the interested readers of *Insulation:* for example, *Journal of Chemical Education, Science,* and especially the *IRE Transactions on Education.*

"The last named quarterly has considered many aspects of the question and the latest issue is most appropriate, Volume E-4, Number 1, March, 1961: 1) A New Approach to Electrical Engineering Laboratories, by S. Plotkin, University of Southern California, proposes 'to limit the objectives as well as the laboratory time, which would result in an advanced electrical measurements course with an associated laboratory to demonstrate the lecture material.' 2) The Paradox of Education in Industry, by Y. M. Hill, General Products Division of IBM, shows how 'engineering education in industry has been introduced in order to make it practical for the engineer to find a satisfying division of effort between immediate job goals and longer-term knowledge objectives.' 3) Editorials, by editor W. R. LePage, of Syracuse University, appear in nearly all issues, are excellent and to the point. Especially pertinent to the question is his editorial in the December, 1960 issue. By the vigorous cooperation of educators, industry, and technical societies, a Workshop on Solid-State Electronics became a successful experiment in electrical engineering education. It 'may serve as the forerunner of a series of specialized technical meetings designed especially to meet the needs of electrical engineering educators.' Why not have a Workshop on Insulation? ASEE Chairman J. H. Mulligan, Jr., New York University, is soliciting comments on this proposal.

"I especially call to your attention an announcement by the AIEE-NEMA Electrical Insulation Conference establishing a standing Committee on Education."

D. L. Babbin

Head, Compounding and Development Laboratory, Simplex Wire & Cable Co., Cambridge, Mass.

"An educational program that will meet the needs of engineers and/or scientists new to the field should be designed to organize and complement the knowledge acquired by the individual in his day-to-day employment.

"Such a program should consist of the basic technologies with the ultimate goal of building a working knowledge and understanding of the vocabulary and principles of the fundamental sciences common to the field of electrical/electronic insulation.

"Professional journals may actively participate in such a program by including articles and short courses on pertinent subjects.

"However, the professional societies in cooperation with industry, trade journals, and local educational facilities are in the best position to organize and sponsor educational programs. I believe that such a sponsorship furnishes the best over-all balance and objective treatment of the subject matter in an educational program."

Jack Swiss

Manager, Insulation and Chemistry Dept., Materials Laboratories, Westinghouse Electric Corp., Pittsburgh, Pa.

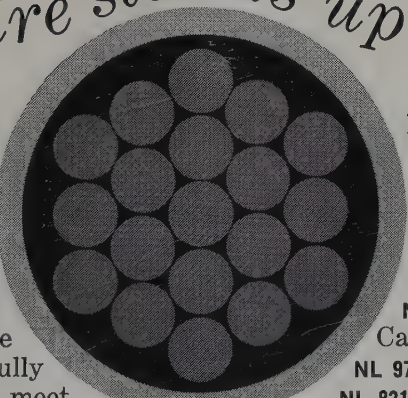
"We have found that a graduate course of 3 semester hours in 'Principles of Electrical Insulation' given by a Westinghouse lecturer, Dr. G. M. L. Sommerman, in the University of Pittsburgh has been very effective in providing practicing engineers and chemists with a good background in insulation. This course emphasizes theory and principles, but many practical examples are used for illustration. Where possible, the behavior of insulation is correlated with other dielectric properties, physical properties, and chemical structure.

"Much of the course is still based on nine sections of notes (chapters) written about 12 years ago by Drs. L. J. Berberich, T. W. Dakin, and myself. These notes are now supplemented by the use of articles in the recent literature on dielectrics and insulation as well as material selected from reference works since 1959 by Heywood and Co. Ltd., London.

"The course outline is as follows:

1. Atomic and Molecular Structure of Matter.
2. Properties of the Electric Field and Dielectric Terminology.
3. Methods of Measuring Dielectric Properties.
4. Conduction Phenomena in Dielectrics with Direct Electric Fields.
5. Dielectric Constant and Dielectric

Nelco coated wire stands up to the elements



What's the "hidden ingredient" you look for in a lacquer? It's the organization behind it. Research. Testing facilities. Pilot plant runs. Production capacity. And of course experience.

That's what makes Nelco lacquers the *lacquers with a difference*. They're not just "mixed" — they're carefully *formulated* to make certain they'll meet your strictest specifications.

Of our hundreds of stock formulations for wire and cable coating, we've listed a few here. With our unique facilities we can *custom* formulate still others to meet special requirements.

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Look at this array of lacquers. High temperature resistant. Clear, glossy film. Flame retardant. Fray prevention. MIL spec. finishes. Fungus resistant.

NL 7147 Nelco Clear Cable Coating

NL 8223 Nelco Clear Heat Resistant Cable Coating

NL 9731 Nelco Flame Retardant Saturant

NL 8211 Nelco Moisture Resistant Saturant

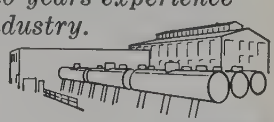
NL 9776 Nelco Clear Cellulose Acetate Cable Coating

R 4026 Nelco High Temperature Resistant Cable Coating

R 5979 Nelco Clear Nylon Cable Coating

R 6625 Nelco Ribbon Cable Adhesive

Back of Nelco lacquers are 40 years experience serving the wire and cable industry.



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Not just mixed ... they're formulated

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Loss in Alternating Fields.
6. Electric Breakdown.
7. Gaseous Insulation.
8. Liquid Insulation.
9. Solid Insulation: A) Polymers, B) Fibrous Materials, C) Inorganic Materials.
10. Thermal and Other Environmental Influences.
11. Effects of Corona and Nuclear Radiation on Dielectrics.
12. Application of Electrical Insulation to Apparatus."

I. J. Marwick

Electrical Engineer, Rome Cable Division of Alcoa, Rome, N. Y.

"At the undergraduate level, a student who is preparing for a technical career in industry must generally take either a conventional course in engineering or else he can study in the fields of chemistry or physics. These are probably the best ways to prepare for future work in the electrical insulation industry. I do not believe that a combination program or option is presently available at an undergraduate level which fully provides the application and design aspects of an engineering degree plus the essential theoretical background provided by courses in chemistry or physics. Perhaps such a program could be offered and promoted by some colleges for anyone who may have made the choice at an early time, and is interested in such a course of study. Most of the people now in the industry have received their formal education in one of the above fields, and have then found it necessary to supplement that education through working experiences, contact with their associates, or through further formal study in college level courses or their equivalent.

"For those already in the insulation industry but who lack experience, I believe it is to advantage of the employer to encourage further formal study in specialized areas, to promote attendance at industry technical meetings, and to provide a good reference library with an adequate selection of technical books and periodicals. In this manner, technical personnel can increase their knowledge in their particular fields and provide a greater contribution to the industry."

J. Handelsman

Assistant Senior Engineer, Eclipse-Pioneer Div., The Bendix Corp., Teterboro, N. J.

"By the very fact of rapid advances in all fields of technology, specialization has become a necessity, though not always a beneficial one. Because he cannot keep abreast of all the latest information, even in those fields closely related to his own work, the engineer and scientist must depend on other sources to assist him. It is in this area that industry and the colleges should combine and expand their efforts. The colleges, while concentrating on presenting a broad technical education, should also expose the student to specific industrial experiences in order to more effectively prepare him for his profession. On the other hand, industry should periodically return the engineer to the campus as part of his regular work schedule for intensive survey courses in fields of his specific interest. This type of reciprocal program would be of special importance to rapidly growing industries such as insulation, where a scarcity exists of personnel with the necessary educational training or industrial experience."

G. L. Moses

Manager, Services Engineering, Large Rotating Apparatus Dept., Westinghouse Electric Corp.

"The importance of electrical insulation to the manufacturers and the users of electric equipment alike is so great that increased emphasis on education is needed in several areas. In my opinion, the following program should be undertaken:

1. Colleges and universities should plan to better prepare students at the undergraduate level for future work in dielectrics and insulation. They should train engineers to apply basic principles to the solution of insulation problems.
2. Industry should provide 'on the job' training in insulation engineering, design, and application. Companies who have a sufficient number of engineers interested in insulation should arrange to have classes and give lectures on insulation subjects. These should be supplemented by periodic symposia for interested personnel where insulation subjects may be discussed.
3. The universities and industry should collaborate in establishing evening classes in dielectrics, and insulation design and application at the post-graduate level; thus, preparing qualified engineers for advanced degrees while specializing in insulation work.
4. Professional societies and trade associations should provide instruction in the fundamentals of electrical insulation and in various specialized areas at their general conferences, both at the local level and at the national level.

"I am happy to report that work is in progress on all four of these items. The AIEE Education Committee and the Electrical Insulation Committee sponsored a session on the first item at the AIEE Summer Meeting at Cornell University on June 21, 1961. Enlightened manufacturers already are providing some 'on the job' training for insulation people, but this should become more general. Some universities and manufacturers already have established post-graduate courses in dielectrics; however, there is a great deal more to be done in this area. An outstanding example of the educational activities of national professional organizations has been undertaken by the Electrical Insulation Conference in the series of educational programs that it has established on insulation fundamentals and other aspects of insulation education.

"The need for *education in electrical insulation* is great and I urge that we all work together to make it available at every level."

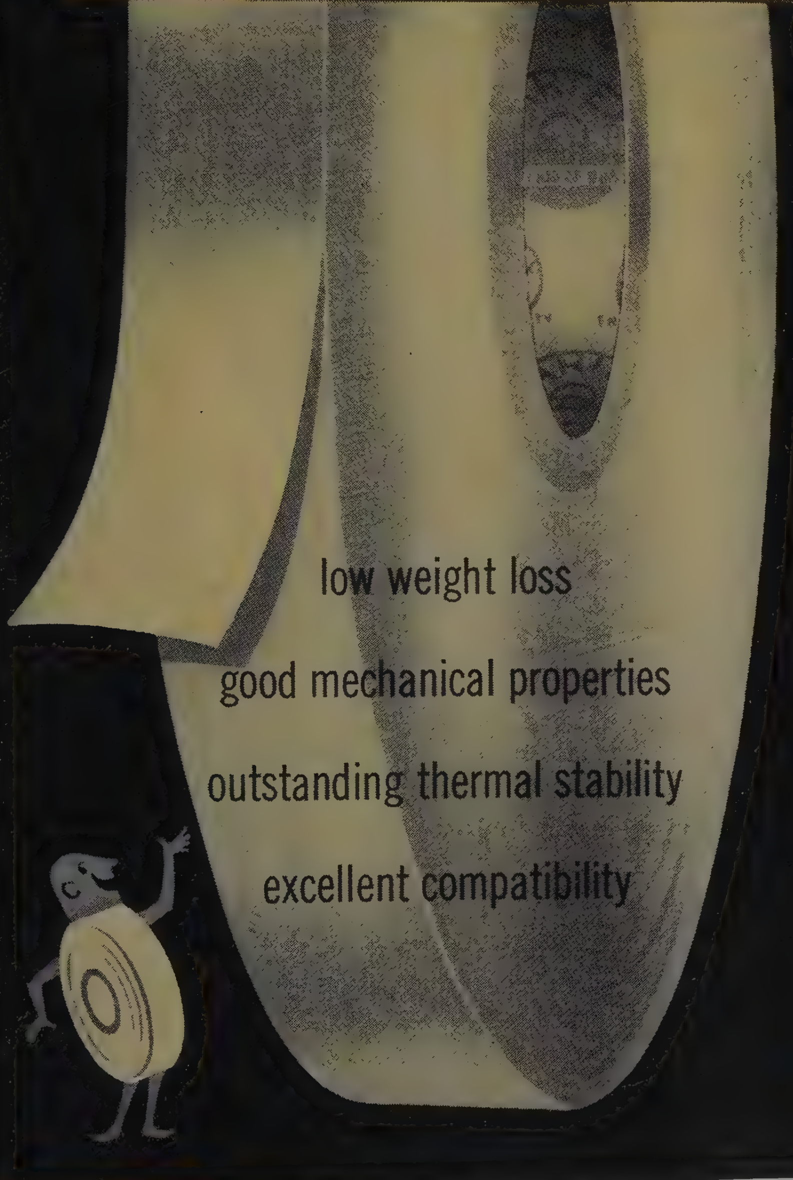
***To Be Continued** — Additional opinions on this* Insulation Forum *topic will appear next month.*

HEAT RESISTANT RESIN-COATED GLASS CLOTH

VARTEX

POLYPOXY TP1052

FLEXIBLE CLASS F (155°C) ELECTRICAL INSULATION



"VARTEX" TP1052 is glass cloth impregnated with a high heat resistant varnish which produces an excellent flexible insulation for operation in the Class F range of temperatures. The glass cloth imparts good mechanical properties while the varnish possesses high dielectric strength.

"VARTEX" TP1052 can be supplied on any base or thickness that fits your application.

- Inquiries are solicited.
- Agents in principal cities.

TYPICAL TEST DATA

THICKNESS	.007" ± .001"
BREAKING STRENGTH	110 LBS/INCH
WT./SQ. YD.	.43 LBS.
VOLTS PER MIL	
AS RECEIVED	1550
RETENTION AFTER 4000 HRS. @ 180°C, ⅛" BENT MAND.	103%

NEW JERSEY WOOD FINISHING COMPANY

MANUFACTURERS OF FLEXIBLE ELECTRICAL INSULATION • WOODBRIDGE, N. J.

VARNISHED CAMBRIC CLOTH AND TAPES • VARNISHED "FIBERGLAS"† CLOTH AND TAPES • VARNISHED SILK AND SILK SUBSTITUTE • SYNTHETIC RESINOUS TAPES AND EXTRUDED TUBING • POLYETHYLENE, SHEETS, TAPES AND EXTRUDED TUBING • CABLE WRAPPING TAPES • "VARSIL" SILICONE VARNISHED "FIBERGLAS"† CLOTH AND TAPES • "VARSLOT" COMBINATION SLOT INSULATION: – RAG PAPER AND VARTEX VARNISHED CAMBRIC • FISH PAPER AND VARTEX VARNISHED CAMBRIC • RAG PAPER AND "MYLAR"* POLYESTER FILM • ASBESTOS PAPER AND "MYLAR"* POLYESTER FILM • KRAFT PAPER AND "MYLAR"* POLYESTER FILM • VARTEX VARNISHED "FIBERGLAS"† AND "MYLAR"* POLYESTER FILM • SPECIAL COMBINATIONS AVAILABLE UPON REQUEST.

*Mylar, DuPont's registered trademark

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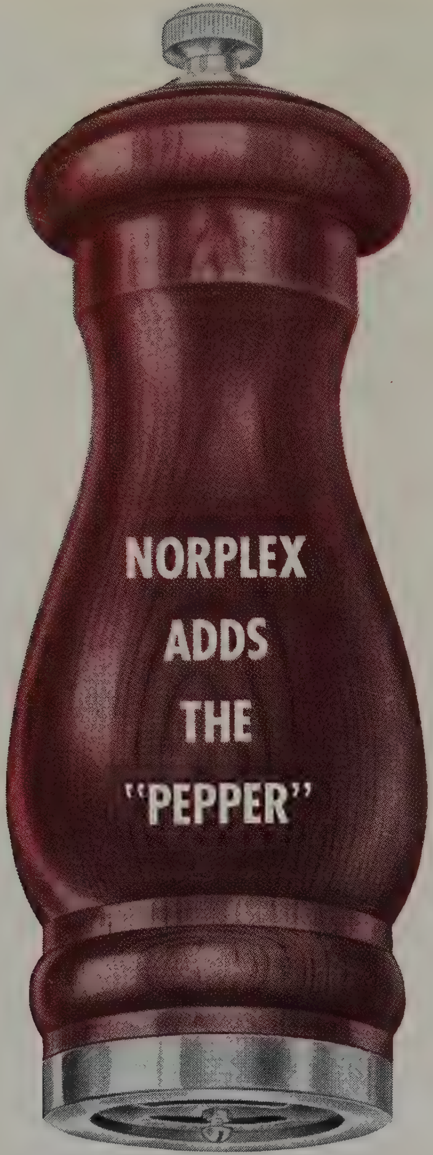

Any laminate job worth its "salt". . . deserves the "pepper" of NORPLEX quality, versatility and service. Whatever your industrial laminate requirement may be . . . from flame retardancy, arc and high insulation resistance to hot and cold punching and mechanical uses . . . NORPLEX has either the standard grades (over 60) or the research and development facilities to serve you best. NORPLEX laminates conform to or exceed N.E.M.A. and MIL-P specifications. Write for our free brochure today . . . find out how NORPLEX "pepper" saves you time and money and delivers top quality.

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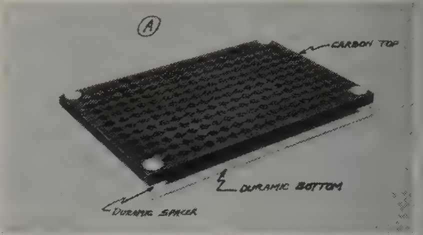
Improved Process for Glass-to-Metal Seals

Glass-to-metal seal manufacturers, using "Duramic" high temperature ceramic tooling, are said to have made some significant advances in their process in terms of leak-proof yield and basic tooling costs.

One solution has been through design of the mold cavities eliminating any glass contact with the Duramic; and the other approach has been to use carbon inserts in those portions of the Duramic mold in contact with molten glass.

The illustration shows a typical glass-to-metal seal mold assembly. The bottom plate sub-assembly consisting of a bottom plate and spacers is made of Duramic, while the top plate where glass contacts the mold is still made of carbon. In this case, the Duramic sub-assembly outlasted the carbon top by more than 10 to 1. In terms of tooling costs this meant a minimum savings of 40%. And just as important, the volume of carbon passing thru the sealing ovens was reduced by 60%, thereby minimizing the amount of reducing atmosphere created by the former all-carbon mold assembly. This has produced significant increases in the leak-proof yield. Another feature in this ceramic sub-assembly is that tolerances on header lead lengths have also been improved.

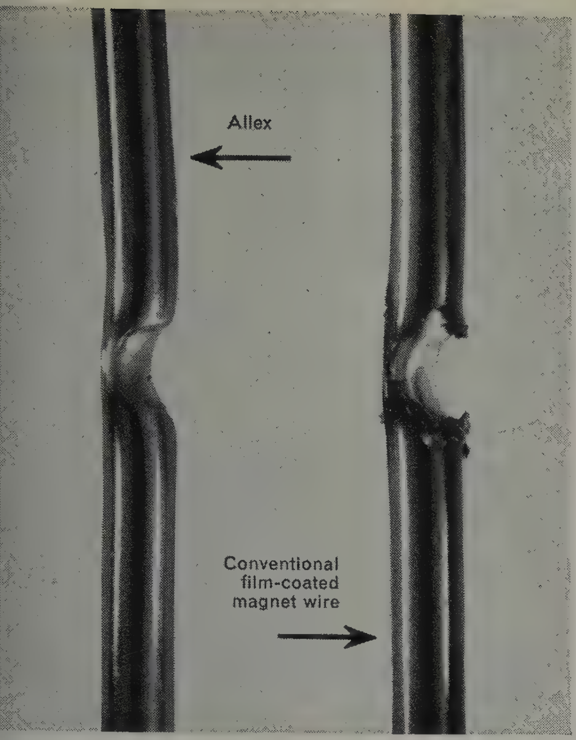


The company (Duramic Products Inc., Palisades Park, N.J.) has also produced all-ceramic molds designed to prevent glass contact and ceramic molds with carbon inserts.

A young couple were exchanging ideas on marriage. "I won't get married," said the boy, "until I find a girl like the one Grandpa married." "You don't find women like that today," said the girl.

"No?" said her boyfriend. "Grandpa just married her yesterday!"

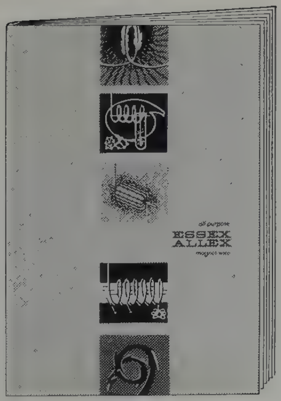
—Reichhold Chemical's "By-Gum"



EXTRAORDINARY CUT-THRU RESISTANCE!

Unretouched photo of #18 gauge wires which had been subjected to the constant temperature (250°C.) increasing pressure cut-through test. A 60 pound weight which deformed the conductor did not rupture the film on Allex.

New technical report proves why all-purpose ESSEX ALLEX is a major advancement in magnet wire



Complete technical report now available. Write for your copy today.

Contains full information on application and on electrical, physical, chemical and thermal properties.

You can do more with Allex, the new all-purpose magnet wire with the greater safety factor. Film-coated and rated at 220°C, Allex is a magnet wire enameled with DuPont ML resin.* This major advancement should permit further product miniaturization, and provides an entry into new frontiers of elevated temperature design.

** E. I. duPont De Nemours & Co. — Type ML Resin.*

MAGNET WIRE DIVISION

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Fort Wayne, Indiana
National Network of Warehouses and Sales Offices . . . Call Your Local "Essex Man."

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European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Ill.

High Voltage Insulators in the Making

From the Beama Journal, February 1961, pp. 6-7.

Doulton Industrial Porcelains Ltd., Wilnecote, Staffordshire, England, presents a new support insulator made of elements in the form of cones, fitting one inside the other and bonded by cement.

This "Multicore" insulator has the following properties (upright, outdoor type):

	Rated Voltage	
	275 kv	*380 kv*
Visible corona (with 22 in diameter ring), kv	220	280
Dry flashover, kv	661	762
Wet flashover, kv	546	686
Impulse voltage withstood, kv peak	1050	1425
50% impulse flashover, kv peak	1456	1810
Total creepage, in	300	400
Protected creepage, in	150	200
Vertical working load, kg	907	907
Tensile breaking load, kg	9070	9070
Torsion working load, kg/m	1786	1786
Cantilever working load, kg	227	227
Cantilever breaking load, kg	907	907
Deflection at working load, mm	5.6	7.1
Vibration test load, kg	227/567	227/567
Overall height, m	2.8	3.56

The Resistance of Sheet Insulation To Surface Discharges

By G. H. Mason in the Proceedings of the Institution of Electrical Engineers, Vol. 107 A, 1960, No. 36, pp. 551-563.

The author is one of the leading authorities in the field of the mechanism of discharges in solid insulation material. The paper also corresponds fully to facts gained from experience concerning the test technique.

Results of time-to-breakdown tests on sheet and laminated materials are given, the influence of ambient temperature and applied mechanical strain is investigated, and recommendations for standard tests to compare the discharge resistance of materials are also given.

The proposed discharge resistance test clearly differentiates materials in respect of their resistance to breakdown by discharges. Using this simple test arrangement, it is possible to obtain reproducible results. The author emphasizes that the correlation between the results of this test and the behavior of the materials in service has yet to be established. These results should, therefore, not be used for design purposes unless the differences between test and service conditions are fully considered.

A selection of the results published in the paper is given (see figures 1, 2, 3 and the tables).

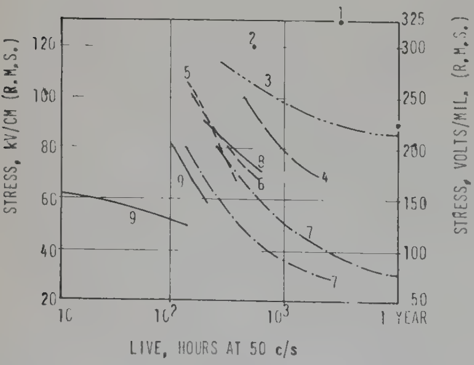
Research on Performance of High-Voltage Insulators in Polluted Atmospheres

By G. S. Forrest, P. I. Lambeth, and D. F. Oakeshott in the Proceedings of The Institution of Electrical Engineers, Part A, Vol. 107, No. 32, April 1960, pp. 172-196. The authors are with the British Central Electricity Board Research Laboratories.

The authors present the important results of their experiences with pollution on high voltage equipment during the last 15 years. Later experiences with 275 and 380 kv systems are also given.

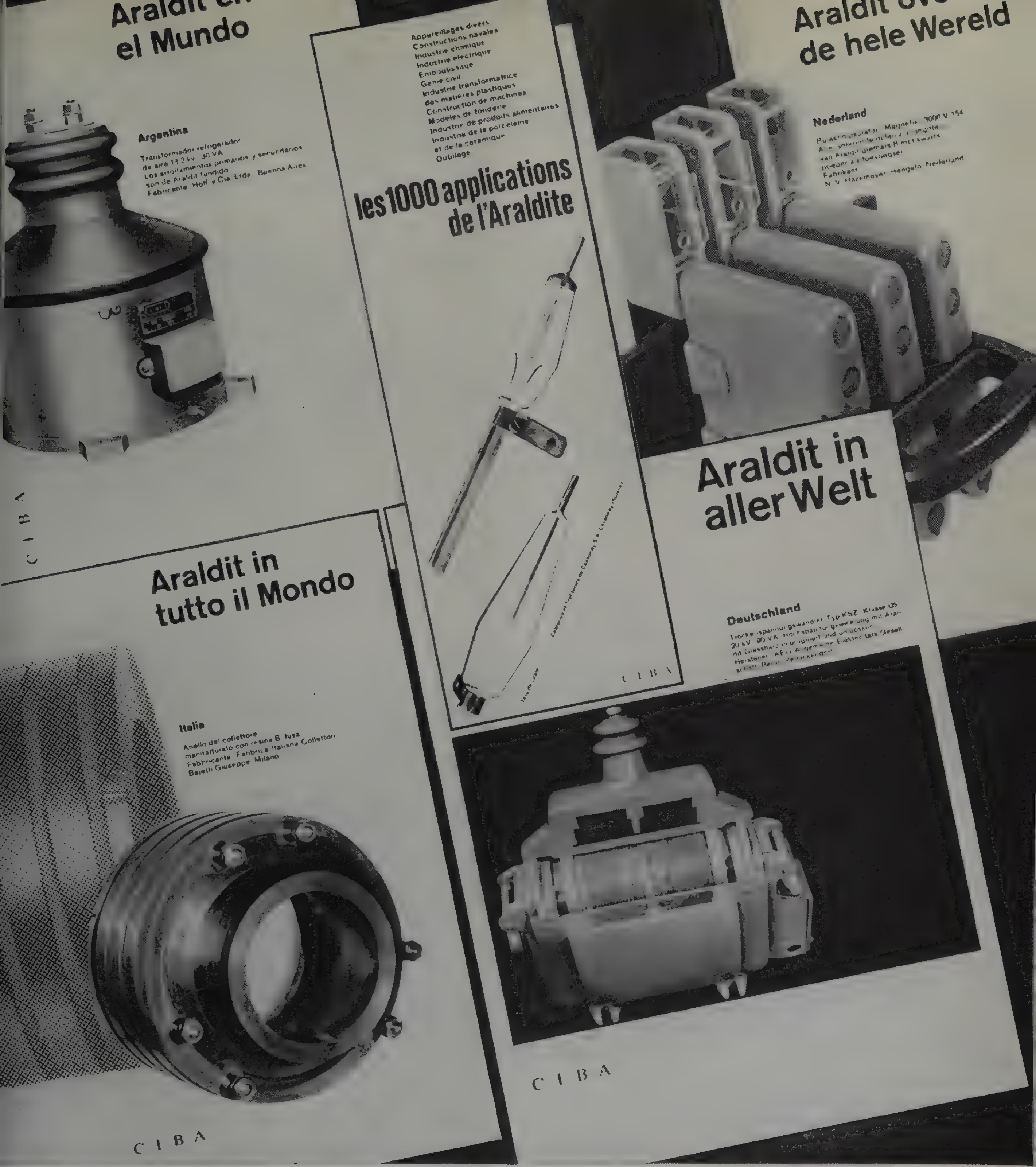
The greater part of the tests was carried out in the insulator testing station at Croydon, which has been in use since 1934. As an example of the severe climatic conditions prevailing, the weight of solids deposited during the six winter months of 1951-52 amounted to 78 tons/square mile and the average concentration of sulphur trioxide was 2.4 mg. per 100 cm^2 per day.

To supplement the natural pollution tests, an artificial pollution test is being developed to evaluate insulator performance in coastal regions subject to salt spray. The author describes the artificial pollution tests as follows. A 15% common-salt solution is pumped into the inlet side of a 7.5 hp fan which breaks it up into a fine spray, which is fairly even in density. This spray rises to a height of 6 or 7



Code	Material	Thickness	Number of tests	E_i at 20°C	Life at 50 c/s at 75 kV/cm	
					20°C	120°C
		mm		kV/cm r.m.s.	hours	hours
1	Silicone rubbers	1·1	8	20 ± 1·5	10^4	10^4
2	rubbers					
3	Silicone-glass	1·1	12	20 ± 2	10^4	10^4
4	Linear polythene	1·6	15	18·5 ± 1	$1·3 \times 10^3$	350 ± 25
5	Polyvinyl chloride	1·5	15	14 ± 1	300 ± 150	-
6	Polymethyl methacrylate	1·5	12	14·5 ± 1	400 ± 25	-
7	Epoxy-glass	1·5	25	10·2 ± 1	320 ± 50	160 ± 25
8	S.R.B.P.	1·6	6	9·7 ± 1·5	500 ± 50	-
9	S.R.B.P.	1·6	15	10 ± 1	125 ± 25	0·1

Figure 1, discharge resistance of sheet polymers compared with that of representative glass and paper laminates. Tests in dry air between high voltage 6.35 mm diameter rods and a plane low voltage electrode. E_i= discharge inception stress.



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ins only to be formulated
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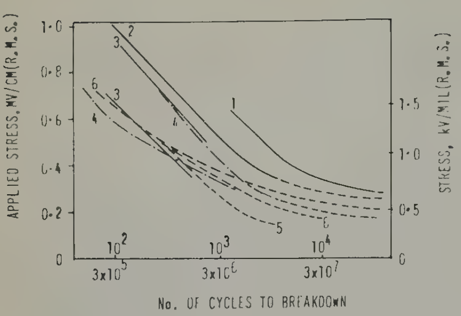
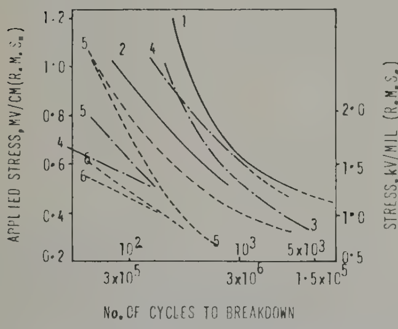


Code	Material	Thickness	Temperature	No. of tests	E_i	Life at 0·4 MV/cm		Maximum coefficient of variation
						40 ± 10 u samples	70 ± 10 u samples	
		microns	deg C		MV/cm r.m.s.	min	min	
1	Polythene	65 ± 5	20	17	0·18 ± 0.03	-	5000 ± 1500	7·5
2	(Grade 2)	35 ± 5	20	60	0·25 ± 0·05	2000 ± 800	-	18
3	Polycarbonate	41 ± 1	20	12	0·25 ± 0·02	1200 ± 50	-	6
4	Makrafol		120	12	-	370 ± 70	-	8
	Polythene	45 ± 7	20	42	0·16 ± 0·04	1150 ± 400	-	18
	(linear)		105	24	-	520 ± 120	-	10
5		75 ± 5	120	14	-	-	500 ± 150	14
	Melinex		20	26	0·20 ± 0·05	800 ± 250	-	10
		40 ± 5	120	16	-	650 ± 80	-	7·5

Figure 2, effect of stress and temperature on the discharge resistance of thin sheet insulation. The curves show the mean life of specimens tested in dry air between 6.35 mm diameter high voltage rod electrodes and a low voltage electrode of 6 in radius of curvature.



Code	Material	Thickness	Temperature	No. of tests	E_i	Life at 0·6 MV/cm 50 c/s	Maximum coefficient of variation
		microns	deg C		MV/cm r.m.s.	min	%
1	Polythene	32 ± 5	20	20	0·3 ± 0·05	1400 ± 150	6
	Grade 2						
2	Polythene	41	20	40	0·19 ± 0·03	500 ± 200	18
	Grade 7						
3	Linear polythene 1	44 ± 5	20	20	0·25 ± 0·05	700 ± 300	18
			105	10	-	110 ± 25	12
4	Linear polythene 2	44 ± 8	20	20	0·25 ± 0·05	1100 ± 350	20
			105	10	-	60 ± 35	20
5	Melinex	39 ± 3	20	36	0·3 ± 0·05	250 ± 70	12
		32 ± 2	120	10	-	150 ± 50	15
6	P.T.F.E. from dispersion	32 ± 2	20	15	0·21 ± 0·03	45 ± 17	25
			105	10	-	25 ± 15	25

Figure 3, effect of stress and temperature on the discharge resistance of thin sheet insulation. The curves show the mean lives of specimens tested in dry air between the crossed δ cylinder electrodes. Electrode spacing: 100 microns.

feet and carries to a distance of more than 25 feet from the fan, thus completely enveloping the insulator.

This test gives results within a very short period of time, i.e. hours. However, although these results are only relative and cannot be transferred directly to service conditions, they can be used to compare different types of insulators not only for salt but also for industrial pollution.

In both tests, the criterion for failure is the time to flashover and the voltage applied corresponds to the maximum continuous phase-to-earth working voltage of the system to be tested. As a measure of the behavior of the insulator when energized at 50 c/s, the number of current surges higher than 150 and 25 ma, respectively, are registered using a counter.

Results of tests with different types of suspension, bushing, and post insulators are given. However, in spite of all these interesting results, it is not possible to state clearly which is the best type and so the choice between anti-fog rod, anti-fog disc, and anti-fog cap-and-pin insulators continues. It was confirmed, however, that the leakage path length is the main factor in determining insulator performance in polluted atmospheres. It is proposed that for an anti-fog suspension insulator, the ratio of the length of the leakage path to the overall length of the insulator be 3.

Insulators with a surface treatment of oil (oil bath insulators and especially hydrocarbon greases) give very satisfactory results. Silicones also give comparable results but are too expensive and at the moment tests on polyphenyl resins are incomplete. Since there are only a few current surges before breakdown, this method of testing does not give enough information about the condition of the surface of the insulator.

Since 1940, tests have been carried out with semi-conducting surfaces to try to bring about a stable voltage distribution. The low loss current of approximately 1 ma causes a drying of the surface. After the first failures due to electrolytic corrosion, glazings with positive temperature coefficients are now being investigated. The authors expect success. The control of the required current can be effected by means of a multiplication of the insulator capacity. Such glass insulations are being investigated at present.

So far it has not been possible to find a substitute for porcelain and glass for outdoor installation in the Croydon atmosphere.

The normal cleaning of the contaminated insulators in the installation with and without voltage is recommended.

Results obtained with 115 kv d-c showed that about 30% longer creepage paths are necessary for high-voltage direct current than for alternating current of the same peak voltage.

Creeping Current as a Possible Cause of Explosions

By E. F. Richter and W. Knittel in Kunststoffe Vol. 50, (1960) pp. 267-276. Original title: Der Kriechstrom als mögliche Ursache von Explosionen.

Explosion protection is specified

SILICOLOGY Studies in Silicones

HOW THESE TIME-TESTED MATERIALS
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Silicone Insulation Insures Reliability—And You Can Afford This Economy Compound

The reliability that silicone rubber insulation affords is a sales feature no appliance manufacturer proud of his reputation can ignore. Today, he can get this reliability at surprisingly low cost if his wire supplier utilizes UNION CARBIDE K-1357 "Direct Feed" Silicone Rubber Compound.

The sales-conscious manufacturer knows that customers are demanding *quality* . . . but he also knows that the "cost-squeeze" is on. Silicone rubber provides this quality for modern electrical appliances, and K-1357 is a specially formulated silicone rubber that can be purchased and processed with a steely eye toward the cash register.

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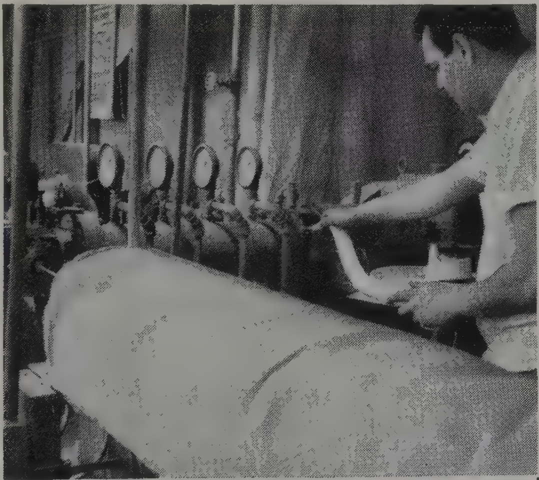
Added reasons why it's good business to do business with versatile K-1357 Silicone Rubber: It is available catalyzed or uncatalyzed, in sheet form. But of particular convenience to companies like Continental, it is also available in coiled strips which feed directly onto their extruders without need of milling and plasticizing. It can be braided without postcure. Either HAV or CV cures can be utilized effectively. The extruded rubber has high-gloss finish, is smooth and nonporous.

Incidentally, K-1357 also extrudes well as tubing, sealing strips, and complex shapes. It can be continuously vulcanized in steam or hot air, on conventional equipment. It can also be compression molded.


Direct-feeding UNION CARBIDE K-1357 Silicone Rubber compound into extruder at Continental Wire Corp. Compound is furnished in coiled strips, needs no milling or plasticizing. Low in first cost, economies multiply.

THREE-WAY BENEFITS

First, appliance manufacturers, second, designers in electrical and electronics fields, and third, wire manufacturers—all three can benefit from the superior physical and electrical properties of K-1357. Especially from its economies, of which a premium element is its non-premium price.

Behind this and many other UNION CARBIDE Silicones are the vast experience and research of Union Carbide Corporation in virtually every field of industry. For information and help, send in the attached coupon today.

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Typical Electrical Properties on Wire*

K-1357	Insulation Resistance**, Megohms/1000 feet			
	HAV Cured		CV Cured	
State of Cure	24 hr. immersion	30 day immersion	24 hr. immersion	30 day immersion
Initial Cure	5,000	7,000	2,500	3,500
Postcured 1 hr. at 300°F.	8,000	8,500	4,500	5,000
Postcured 4 hrs. at 400°F.	12,000	12,000	8,000	8,000

*No. 18 AWG, 7 x 0.0152, 16 mil wall, silver coated copper wire, 60°F. water, 5 minute electrification (500 volts)

**To convert to Insulation Resistance Constant (K factor) multiply by 4.2

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Long Island City 1, N. Y.
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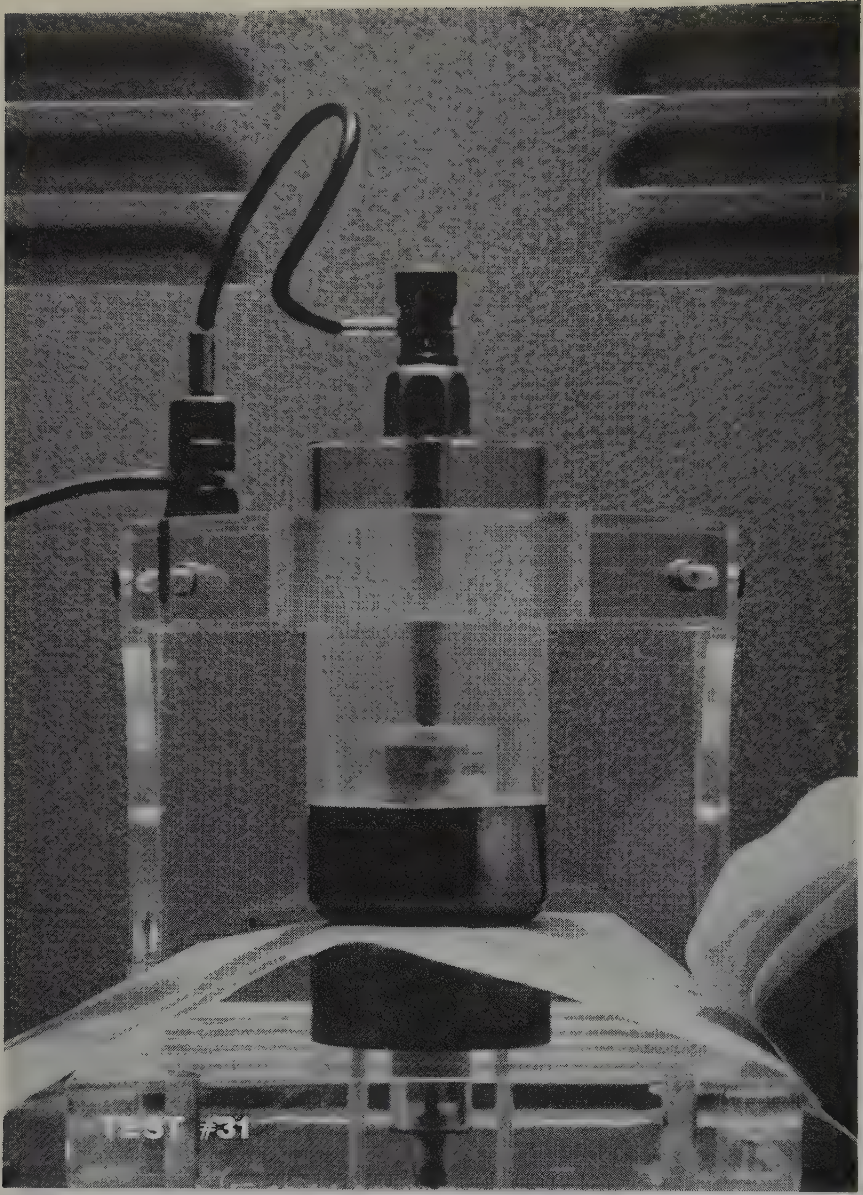

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Although absolute perfection is impossible, Crocker, Burbank goes to considerable extra expense and effort to come as close to it as possible in capacitor tissues.

Every ingredient, every step of manufacture is carefully controlled. 44 separate and distinct tests are made with thousands of individual readings.

Shown here is the ASTM Dielectric Strength test where 60 cycle AC voltage is automatically increased until the tissue breaks down. No Crocker, Burbank tissue is passed unless it exceeds the minimum Dielectric Strength specification for its grade and thickness.

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for a great variety of electrical apparatus, i.e. all sparking and arcing must be suppressed to prevent the resulting high temperatures from causing ignition of any explosive gaseous mixture already existing in the locality. The authors investigate the degree to which the creeping current on the surfaces of insulation materials must be considered as a cause of explosions.

For these investigations, a similar arrangement to that which is customary for the determination of the tracking resistance is used. Drops of liquid are allowed to fall onto the insulation surface which is being tested until a spark occurs between the electrodes. These tests were carried out in an explosion chamber containing a saturated mixture of toluene vapor and air at 30°C. The number of drops which fall until ignition of the mixture takes place serve as a measure of the resistance to sparking.

Approximately 60 materials with different tracking resistances were investigated. From their many interesting results, the authors found that no correlation can be established between the resistance to sparking and the tracking resistance. Therefore it can be concluded that the choice of insulation materials for explosion proof systems cannot be made only on the ground of high tracking resistance.

Change in Procedure for Qualification Testing

A change in the procedure for qualification testing at a non-government laboratory under contract to manufacturers and distributors was recently announced by the director of the Armed Services Electro-Standards Agency, Fort Monmouth, N.J. In the future, all qualification and re-evaluation testing authorized by ASESA will be monitored by a government representative (usually an inspector), and lists of non-government laboratories which have been evaluated by ASESA and found to be suitably equipped and staffed to perform the qualification tests may be obtained from ASESA.

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AGNET WIRE from KENNECOTT-OKONITE

HAT YOU WANT!

necott-Okonite is a single source of supply for ıally every magnet wire requirement. And if on't have what you want in stock, we do have facilities and technical experience to produce magnet wire to fit your needs—promptly, exly and economically.

PES—Kennecott-Okonite manufactures magnet in sizes 2-30 Awg and in these shapes:

ddition, we are equipped to insulate tubular es for special apparatus requiring internally ed magnet wire.

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FIBER-INSULATED

ermal fication	Insulating Material
O—90C	Cotton, Paper, Paper and Cotton
B—130C F—155C H—180C	Glass (Single and Double), Dacron-Glass (Single and Double)

FILM-INSULATED

Thermal Classification	Type Film	Advantages
A—105C	Plain Enamel	General purpose economical insulation.
	Formvar	Excellent all purpose film. Good windability and flexibiity, high abrasive resistance.
	Bondall (Polyvinyl Butyral) over Formvar	For self-bonding coils requiring no impregnating varnish.
	Nylon	Does not solvent craze, high abrasive resistance.
	Nyform	Combines better characteristics of Formvar and Nylon with high thermoplastic flow.
Class B—130C	Solderfilm (Polyurethane type)	Solders in seconds without removal of film or use of flux. Good moisture and chemical resistance.
	Epoxy	Will not hydrolyse, can be used in totally-enclosed units. Good windability, excellent heat shock.
Class F—155C	Kentherm (Polyester)	Can withstand hottest spot operating temperatures of 155C. Good abrasion, chemical resistance, high thermoplastic cut-through.
	PolyKentherm (Polyester plus overcoat)	Improved abrasion resistance, improved heat shock, improved windability.
200 C +	Type ML	Retains all insulation properties at 200C +.

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An Evaluation of Water-Soluble Fluxes—Part 1

By F. Z. Keister, Member Technical Staff, Hughes Aircraft Co., Culver City, Cal.

Introduction

Recent developments in the fields of printed wiring and etched circuitry have created increasing demands for soldering fluxes which are considerably more active than the activated rosin types. This is particularly true in those operations involving mass or multiple soldering of components to etched circuit boards. In these days of ballistic missiles and space vehicles, not only must the fluxing and soldering operations be done on highly miniaturized and intricate circuit boards, but the resultant soldered connections must meet the demands of extreme environments with the highest level of reliability. This investigation was conducted in an attempt to find a soldering flux which would meet these new requirements without introducing corrosion, lowered insulation resistance, or similar deficiencies.

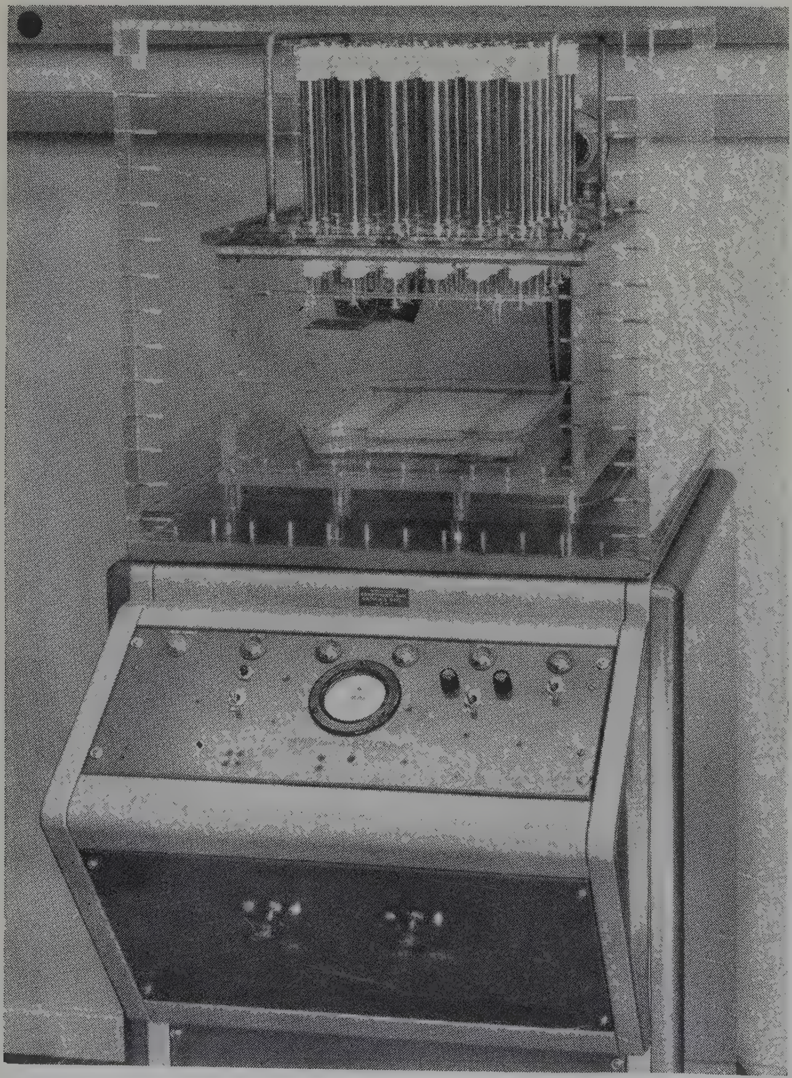


Figure 1, humidity test chamber.

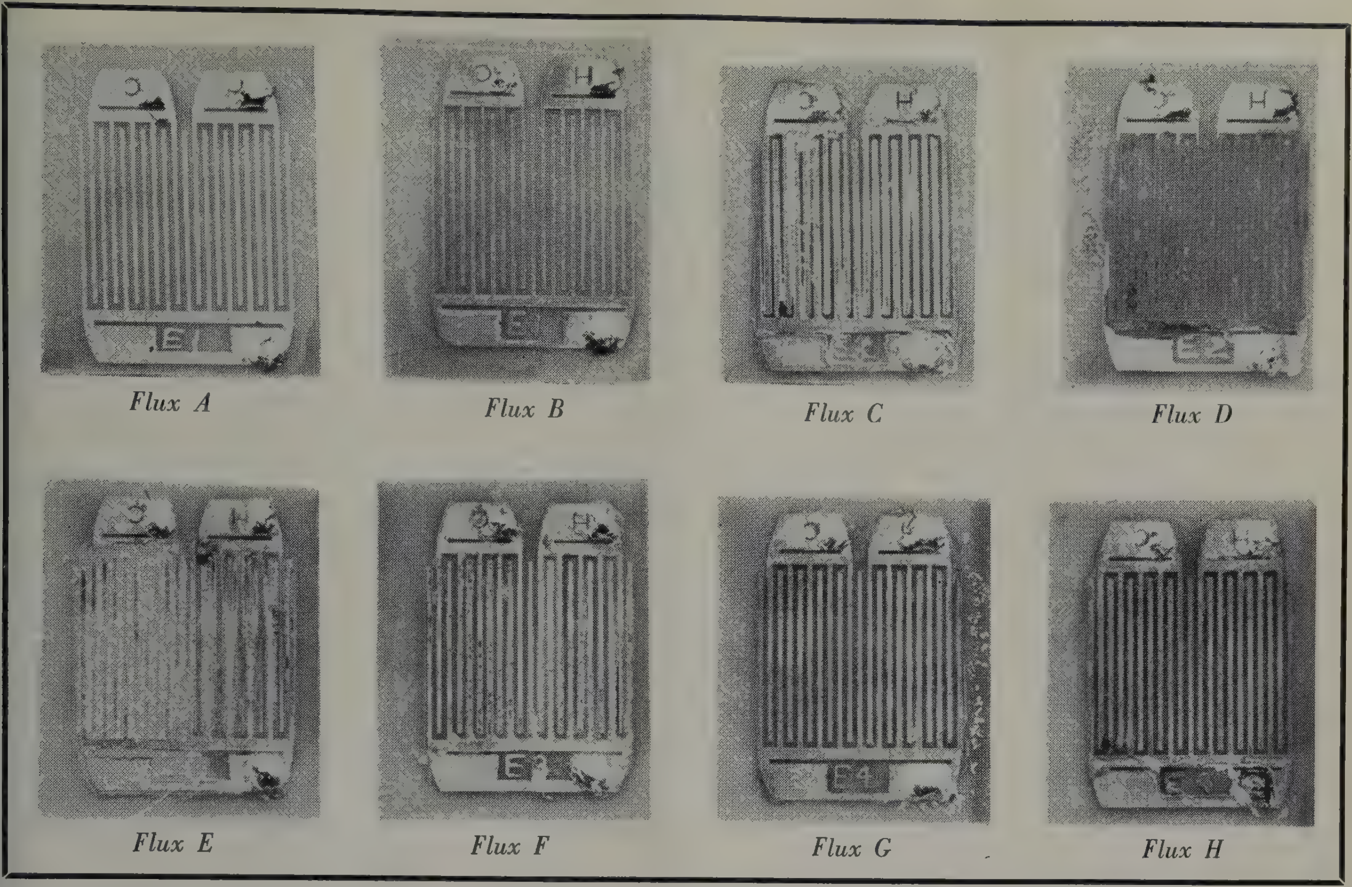
In view of the vast number of soldering fluxes available on the commercial market, it was necessary to restrict this investigation to a type of flux which appeared to show the most promising properties for these etched circuitry applications. In this connection, water-soluble fluxes were selected for the tests as the optimum compromise between fluxing ability, easy removal, and mild corrosiveness.

Fluxes are generally classified into three groups: (1) the chloride or acid type, (2) the organic type, and (3) the rosin type. However, functionally they may also be classified according to the nature of their residues. These may then be divided into three classifications: (1) highly corrosive, (2) intermediate, and (3) non-corrosive. It is with the intermediate or organic category that we are concerned.

Intermediate fluxes are weaker fluxes than the chloride or acid types. They consist mainly of mild organic acids and bases and certain of their derivatives. They are active at soldering temperatures, but the period of activity is short because of their susceptibility to thermal decomposition. Sufficient heat must be applied to fully decompose or volatilize the corrosive constituents. Their residues are usually relatively inert and easily removed with water. Examples of intermediate flux constituents are glutamic acid, urea, aniline hydrochloride, glycerol, and hydrazine hydrochloride.

Six water-soluble fluxes were selected for final testing from an initial screening of eleven water-soluble fluxes obtained from nine different flux manufacturers. In addition, two rosin-base fluxes (pure rosin-alcohol and an activated rosin flux) were selected for evaluation along with the water-soluble types for comparison purposes.

The approximate chemical compo-



Flux A Flux B Flux C Flux D

Flux E Flux F Flux G Flux H

Figure 2, insulation resistance test patterns. Appearance after 24 hours at 95°F and 90% R.H.

sitions of the eight fluxes are as follows:

(1) Flux A

This is a pure, unactivated rosin-alcohol flux.

Water white rosin	10 lbs.
Ethyl alcohol	7 gallons
Methyl alcohol	0.1 gallons

(2) Flux B

This is an activated rosin flux of unknown composition. It is essentially composed of water white rosin (25% to 40% by weight), an organic activating compound (2% to 5% by weight), and alcohol. For testing purposes it was diluted 1:1 with an appropriate flux thinner.

(3) Flux C

This is a water-soluble flux whose exact composition is unknown, but is of the urea-glutamic acid hydrochloride type.

(4) Flux D

This is another water-soluble, mildly acid flux composed of: (a) glutamic acid, (b) urea, and (c) hydrochloric acid in unknown quantities.

(5) Flux E

This water-soluble flux is a water solution of hydrazine monohydrobromide. Its residues have been reported to be non-hygroscopic and noncorrosive.

(6) Flux F

This flux is water-alcohol solution of hydrazine monohydrobromide. It has been reported that this flux is made up as follows:

Hydrazine monohydrobromide	0.2 lb.
Isopropyl alcohol	½ gallon
Distilled water	½ gallon

(7) Flux G

This organic flux is essentially Flux H which has been reduced in strength as follows:

Flux H	80% by volume
Distilled water	20% by volume

(8) Flux H

This water-soluble organic flux is a self-neutralizing aqueous flux made up as follows:

Glutamic acid hydrochloride	70 grams
Urea	40 grams
Distilled water	500 ml.
Wetting agent	A few drops

The remainder of this report will be devoted to a discussion of the eleven separate tests to which each of the eight fluxes were submitted. Whenever possible, test requirements from the following government documents were followed as closely as possible: MIL-F-14256, QQ-S-571, MIL-S-6872, and MIL-F-4995.

Insulation Resistance Test

This test is designed to measure the electrical resistance of the flux residue to the passage of an electrical current. Since insulation resistance is considered one of the most important of the tests conducted, the testing procedure was divided into two separate evaluations: (1) 24-hour test and (2) 30-

day test. The tests were designed to evaluate the insulation resistance after: (a) fluxing; (b) fluxing and solder dipping; and (c) fluxing, solder dipping, and cleaning. Copper clad, glass-base epoxy insulation resistance test patterns were used for the tests in order to simulate actual production conditions as closely as possible.

The insulation resistance test patterns were first cleaned and conditioned for 72 hours in a humidity test chamber (see figure 1) at 90% relative humidity and 95°F to establish a value for each test pattern. The test patterns were then removed from the humidity chamber and treated as described below.

Treatment A—Flux by brushing and air dry.

Treatment B—Flux, air dry and solder dip at 475°F for 7 seconds in 63/37 molten solder.

Treatment C—Flux, air dry, solder dip, and clean to remove flux residues.

Fluxes A and B were removed by an agitated immersion in an alcohol-Freon solvent for 15 minutes. The water-soluble fluxed test patterns were immersed in a cascade rinse of hot distilled water for 5 minutes.

All test patterns were then placed in the humidity chamber for 24 hours at 90% relative humidity and 95°F. After 24 hours each test pattern was charged with 500 volts for one minute and the insulation resistance was measured by a megohm bridge. The test patterns were then removed from the chamber and examined for signs of arcing and corrosion.

The test results are presented in table I. Figure 2 is a photograph of eight different treated patterns after 24 hours exposure to 90% RH and 95°F. These test patterns had been given treatment A (i.e., fluxed only). Referring to table I we observe that only fluxes A and B passed this particular test. The Hughes Aircraft minimum requirement for the insulation resistance of an etched circuit test pattern is 10^{12} ohms per square or, for this comb pattern, a value of 3.3×10^{9} ohms would be considered acceptable. All of the water-soluble fluxes either fell far short of this value or exhibited a short circuit regardless of the treatment given the test pattern.

A different group of insulation resistance test patterns were then submitted to a 30-day test at 90% RH and 95°F with a 45 volt d-c potential applied constantly across all test patterns to simulate actual operating circuit conditions. All test patterns were fluxed, air dried, dip soldered at 470°F for 7 seconds, and cleaned. The cleaning methods employed were considerably more elaborate than those used in the 24-hour test. Table II shows a plot of the daily insulation resistance readings for three of the fluxes. On the whole, the rosin-base fluxed patterns exhibited higher insulation resistance values. Pure rosin-alcohol, as expected, was the best of all the fluxes tested. The majority of test patterns experienced a sharp drop in insulation resistance immediately after their initial placement in the humidity chamber. After approximately 15 days, the values began to stabilize and throughout the remaining 15 days did not change significantly, with the exception of a few unstable fluctuations. Only fluxes C and D failed this test and certain of the water-soluble fluxes (i.e., the hydrazine types) showed characteristics almost equal to those of the rosin-base fluxes.

Table I—Insulation Resistance, 24 Hour Test Results

Flux	Treatment	IR Value Before Test (megohms)	IR Value After 24-Hr Exposure (megohms)
A	A	300,000	500,000
A	B	190,000	500,000
A	C	400,000	180,000
B	A	150,000	130,000
B	B	190,000	1,000,000
B	C	200,000	1,400
C	A	60,000	Short-Arcing
C	B	190,000	1.7
C	C	190,000	17.0
D	A	180,000	1.1
D	B	200,000	Short-Arcing
D	C	200,000	9.0
E	A	180,000	Short-Arcing
E	B	400,000	Short-Arcing
E	C	300,000	170.0
F	A	180,000	Short
F	B	300,000	Short-Arcing
F	C	28,000	350.0
G	A	190,000	2.2
G	B	190,000	1.4
G	C	250,000	20.0
H	A	6,000	Short-Arcing
H	B	190,000	2.3
H	C	190,000	40.0

Solder Dipping Test

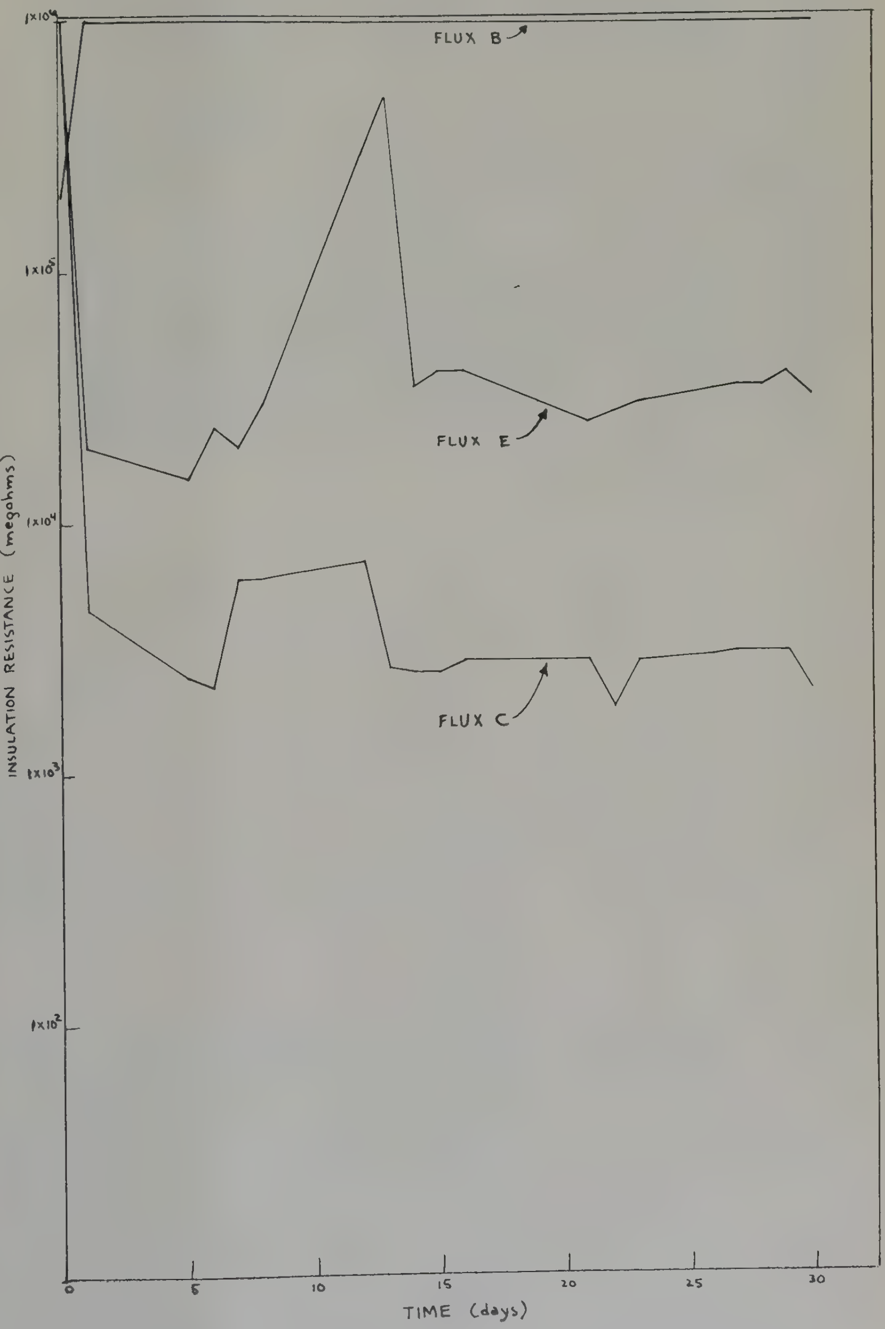
The solder dipping tests were conducted to determine the comparative abilities of the various fluxes to produce high quality solder joints. In order to simulate actual production conditions, both phenolic and epoxy gold plated-thru hole etched circuit boards with redundant circuitry on both sides were used. These board designs are shown in figure 3. Tinned copper bus wires were used to simulate components and all solder dipping was done automatically in order to exercise closer controls during the dipping cycle.

After spray fluxing and drying, the boards were placed in the holding fixture of the dip soldering machine. Figure 4 is a photograph of this machine with an assembled board in position ready to be dip soldered. In all cases the temperature of the molden 63/37 solder was 470°F and the dwell time of the etched circuit board on the solder surface was held to 7 seconds. The immersion depth was controlled so that the etched board was dipped below the actual level of the molten solder, thus forcing solder up through the plated-thru holes and creating solder fillets on both sides of the board simultaneously. The walls of the fixture prevent solder from overflowing on the top of the board. After the solder dip, the boards were cleaned and examined microscopically for defective solder joints on both the top and bottom sides. In addition, the boards were examined for signs of warpage, blistering, lifted pads, burning, solder webs or bridges, solder globules or teardrops, and for the general appearance of the soldered joints. These defects were all assigned values and each contributed to the fraction defective rate.

The results of the solder dipping tests are shown in table III for both the epoxy and phenolic boards. A fraction defective of 25% was considered passing, although 10% or less is desirable for production operations. There were no visual evidences of warpage, lifted pads, blisters, or burning. From table III we note that in all cases the epoxy laminate gave better soldering results than the phenolic laminate. Although this can be attributed to several factors, the primary reason is due to the epoxy base material having a lower thermal coefficient of expansion. The boards fluxed with the highly active water-soluble fluxes (fluxes C, D, and H) exhibited brighter, more uniform solder joints with higher quality solder fillets. It was also noticed that the majority of solder joints (pinholes, in particular) appeared on the top side of the boards.

Another series of tests was also conducted using various solder dipping

TABLE II. Insulation Resistance—30 Day Test Results



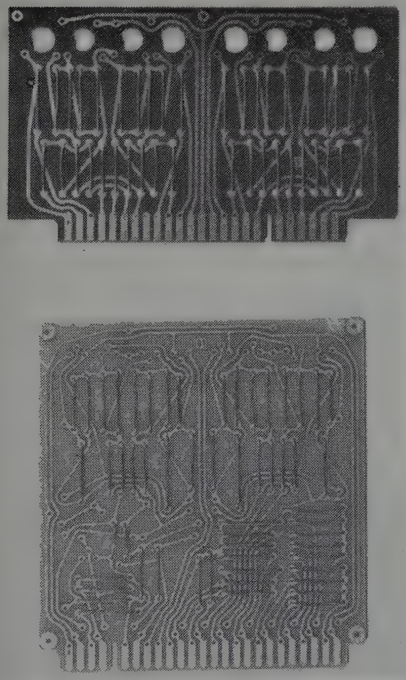


Figure 3, plated-thru hole etched circuit boards.

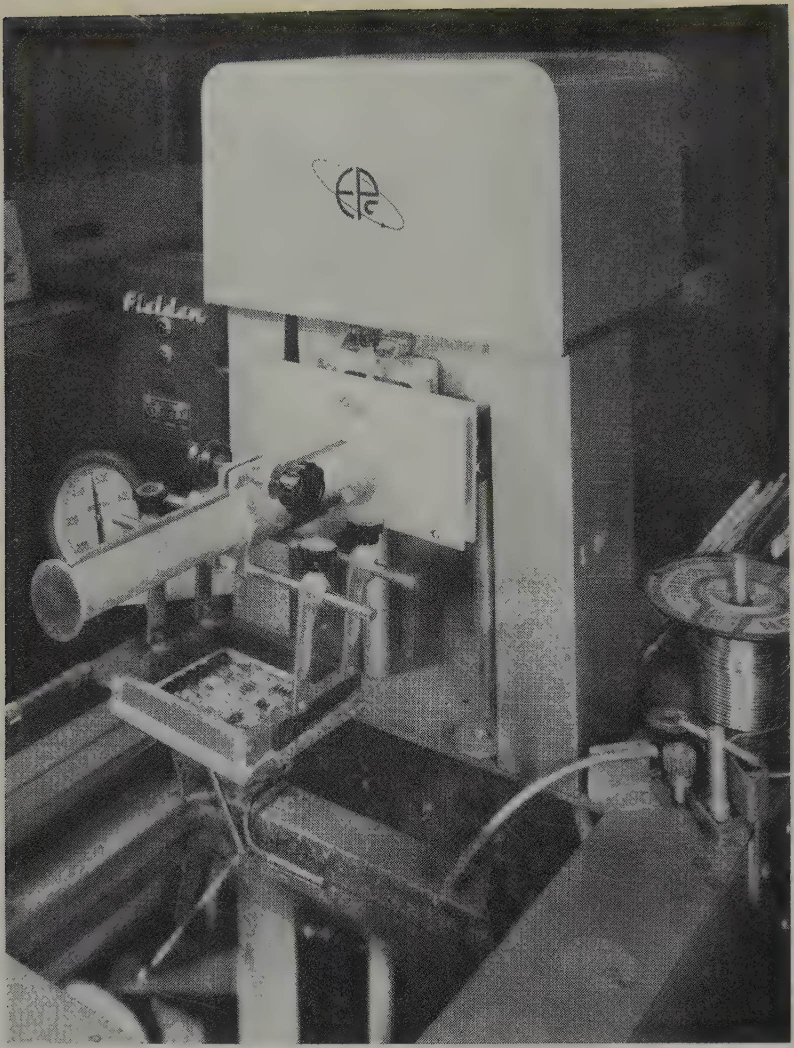


Figure 4, automatic dip soldering machine.

Table III—Solder Dipping Test Results		
Flux	Base Material	Fraction Defective
A	Epoxy	29.5
A	Phenolic	—
B	Epoxy	27.2
B	Phenolic	41.5
C	Epoxy	6.7
C	Phenolic	22.4
D	Epoxy	10.7
D	Phenolic	14.4
E	Epoxy	11.0
E	Phenolic	37.3
F	Epoxy	21.8
F	Phenolic	26.4
G	Epoxy	13.4
G	Phenolic	24.9
H	Epoxy	9.8
H	Phenolic	21.6

techniques in connection with the different fluxes and with different time-temperature soldering cycles. These tests were:

(1) Edge solder dipping eyeletted etched circuit boards.

(2) Selective solder dipping using both steel, aluminum, paper tape, and plastic masks, and using silk screened solder resists.

(3) Mass soldering of plated-thru hole boards using a Flow-solder machine.

(4) Flat solder dipping using a double-dipping technique.

Since the primary results of the above tests, that of establishing the optimum flux, were all in correlation, only the results of the tests using a single flat solder dipping cycle are presented. It should be mentioned, however, that certain of these methods produced consistent fraction defective rates below 3%.

Ed. Note: *The second half of this article will appear in the next issue of* Insulation. *Some of the subjects which will be discussed include an electrically polarized wire test, humidity tests, fluxing action tests, spread factor test, copper mirror test for corrosivity, twisted wire test, flow and consistency test, acid number test, dryness test, and the conclusions derived from these tests.*

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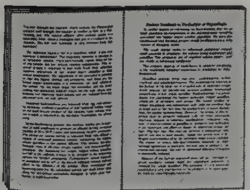

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Print Ins. 15 on Reader Service Card

Copper Foil Tape Simplifies Printed Circuit Model Making for Microwave Components

A pressure-sensitive copper foil tape is being used by Sylvania Electronic Systems, Division of Sylvania Electric Products, Inc., Waltham, Mass., for the development of breadboard models for printed circuit microwave devices.

According to Robert A. Jordan of the R. F. Development Department at Sylvania, who has designed a number of components using this method, the reproduction method is relatively simple. He reports that for some time many engineers have been interested in the advantages of strip transmission line over waveguide and coaxial components. Advantages claimed include size and weight savings as well as lower production costs — which together have encouraged more and more strip transmission line use in the last few years. New materials and techniques now have made possible many advances in strip transmission line devices. New dielectrics along with copper and aluminum pressure-sensitive tape have given the field ever increasing flexibility.

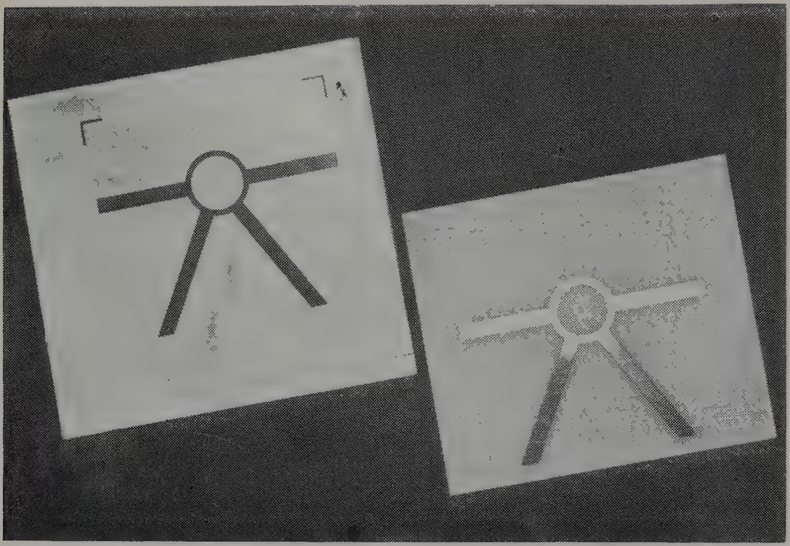
Figure 1, left, ring hybrid before etching; right, ring hybrid after etching.

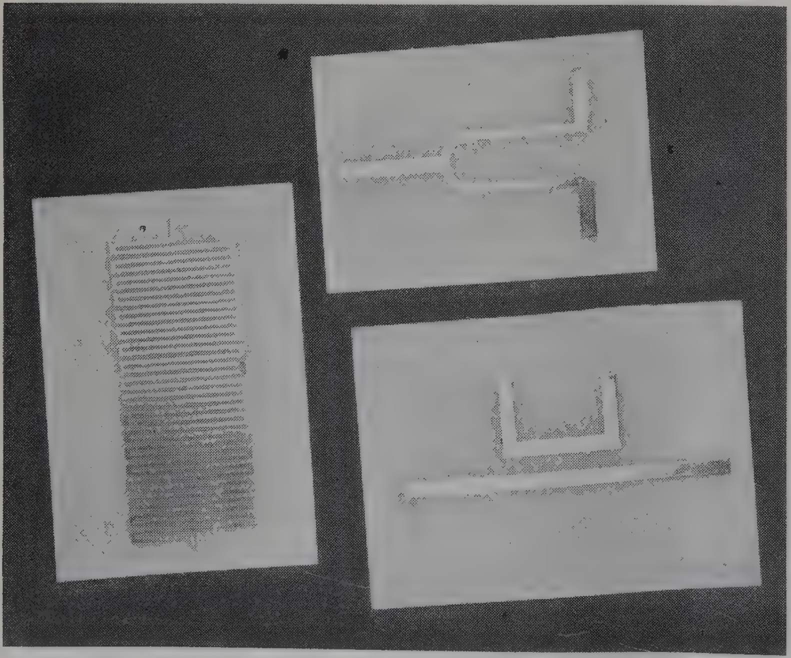
Figure 2, left, delay line; upper right, power divider; lower right, directional coupler.

Jordan states that conventional printed circuits can be readily etched on pressure-sensitive copper foil tape bonded to any base material. In the event of error, any part of the circuit can be removed or changed by simply peeling it off and resticking it in the desired place. Many standard sizes and shapes can be pre-etched and circuits put together in a building block fashion.

At Sylvania many microwave components have been hand cut or photo etched on dielectric base sheets clad with the copper foil tape. The following components have been manufactured using this method:

Power Dividers
Directional Couplers
Ring Hybrid
Filters
Parametric Amplifiers
Delay Lines
Phase Shifters
D-C Isolators
Mixers

The silicone adhesive on the tape reportedly withstands the acids used in all commercial printed circuit work. Therefore, with a little care, photographic methods can be used to print and etch circuits from copper foil tape applied to the dielectric base. In the Sylvania operation this has proven many times to speed up the making of engineering models and to save the cost of machining copper clad dielectric to fit a given package. If a circuit should not meet either electrical or mechanical tolerances it can be removed and replaced with a new sheet of copper foil tape, corrections made, and re-etched over and over as many times as needed. The tape used is Permacel EE 3990 made by Permacel, New Brunswick, N.J.

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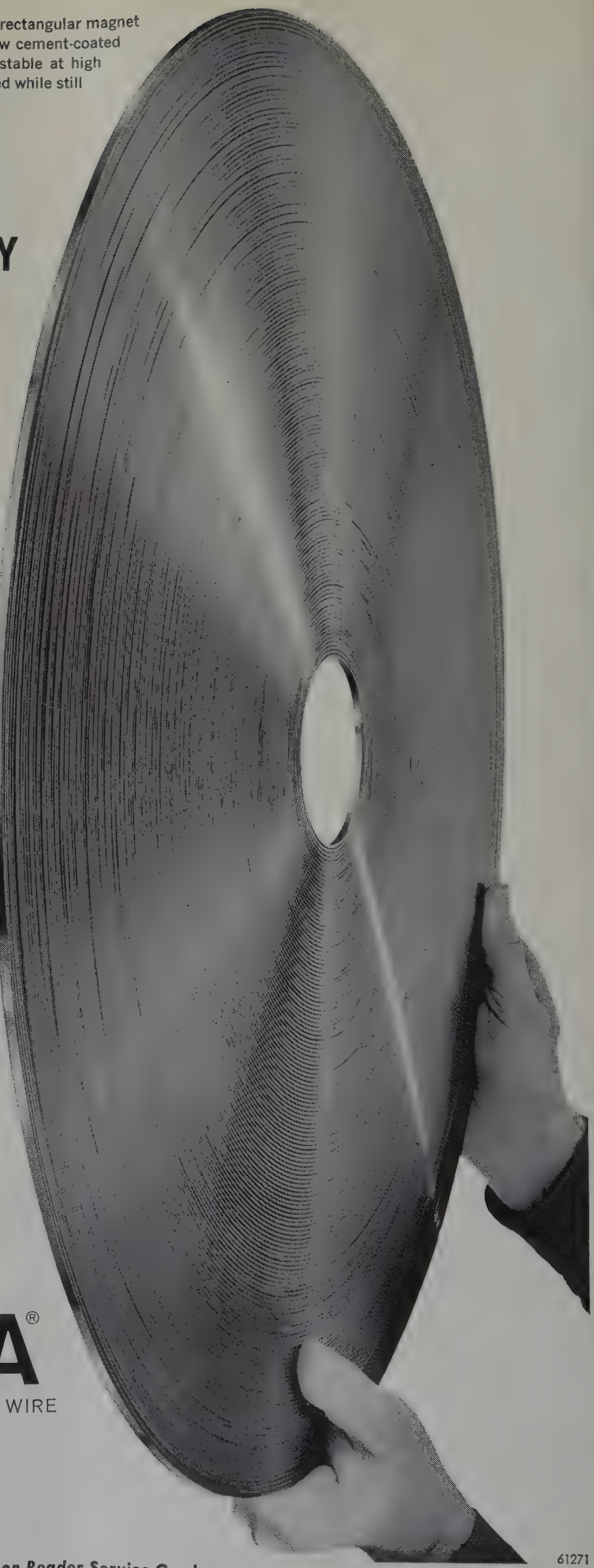

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For more information about Anaconda cement-coated epoxy magnet wire, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-I.

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Molded Polyester-Glass Permits New Insulation Performance Standards in Switchgear and Controllers

By J. A. Marks, Application Engineer, Switchgear Department, Allis-Chalmers Mfg. Co., Milwaukee. All photos courtesy Allis-Chalmers.

Note

Insulation, the principal factor in switchgear and motor control reliability, has reached the present high standard of performance through the use of molded plastics. Development of glass-base polyester plastic presents a new concept in electrical standards of insulation and methods of fabrication.

Introduction

The trend in metal-clad switchgear and motor controllers is toward higher interrupting capacities and continuous-current ratings to meet the increased demand for concentrated electric power in limited cubicle sizes. Extremely important to the overall functioning of metal-clad switchgear are the insulation materials.

Most difficult insulation problems in switchgear exist in the area of primary disconnects and bus joints. Since the main bus in switchgear runs at right angles to the direction of the circuit breaker drawout, a problem exists in transposing from the breaker primary disconnects to the main bus. Figure 1 illustrates this point. Use of molded polyester-glass results in both simplicity and economy in this area

Table I—Polyester-Glass and Phenolic Property Comparisons

Property	Polyester-Glass	Phenolics
Relative Insulating Property Comparisons (%)		
Arc Resistance	2000-25000	100
Impact Strength	500-600	100
Dielectric Strength	150	100
Dielectric Strength (after heat application)	200	100
Dielectric Strength (after immersion in water for 24 hours)	600	100
Additional Comparisons		
Water Absorption (percent in 24 hours)	.4	1.6
Water Absorption After Heat (conditioned for 200 hrs at 150 degrees)	.7	4.0
Power factor (at one megacycle)	1.5	7.0
Power Factor (at 60 cycles)	2.0	40.0
Acid Resistance	Good	Fair
Alkali Resistance	Good	Fair

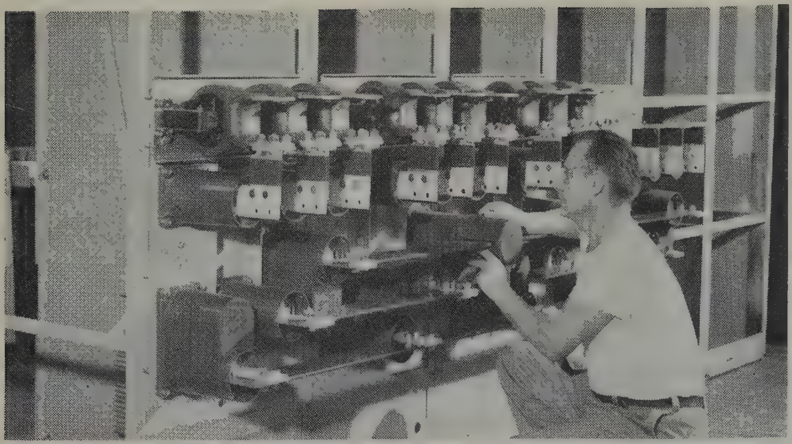

Figure 1, rear view, 4.16-kv metal-clad switchgear showing installation of glass-polyester bus supports. Note wound-type current transformers on load side.

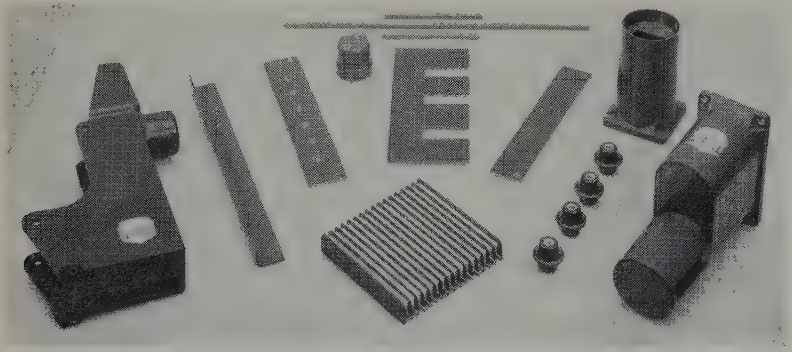

Figure 2, extensive use of glass-polyester insulation in both molded and flat sheet form in switchgear cubicles is shown by various structural forms and molded shapes.

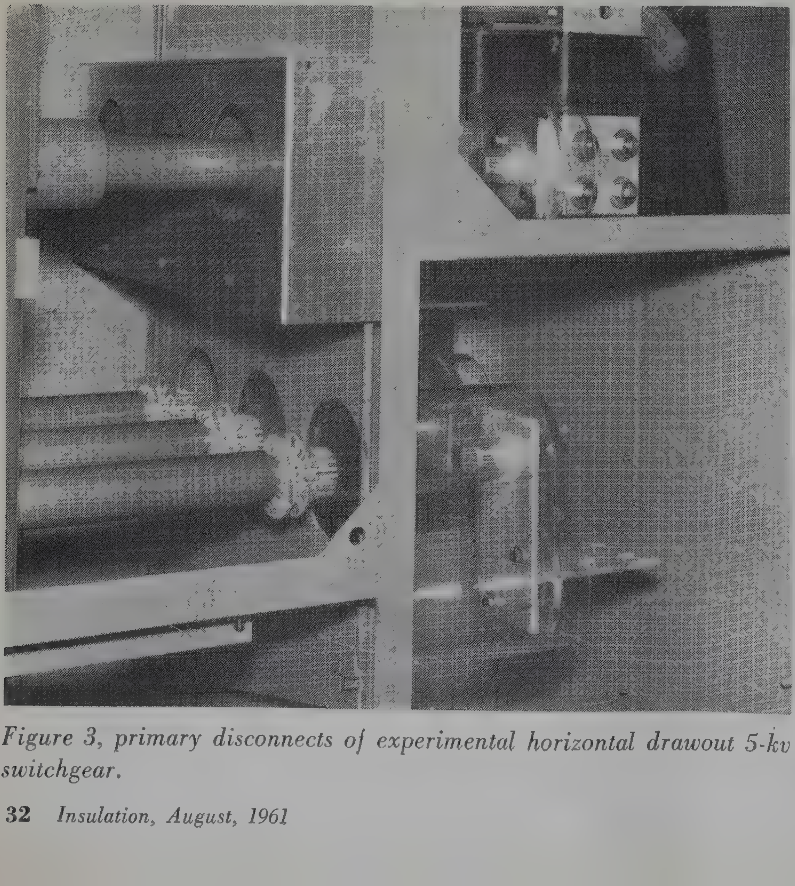

Figure 3, primary disconnects of experimental horizontal drawout 5-kv switchgear.

while increasing reliability and protection.

Similar requirements had to be met in the design of a new 2000 to 5000-volt motor controller. The specifications for this development project called for a contactor with an interrupting rating of 50,000 kva that could be packaged in one-half the space required by existing designs.

This controller is the first to incorporate polyester-glass insulation with an alumina additive that gives it both flame retardance (self-extinguishing) and outstanding carbon tracking resistance. The insulation is used throughout the controller and contactor wherever there is contact with current carrying parts. Because of the new insulation's superior insulating characteristics, controller sizes and weights are greatly reduced and equipment life is extended.

What qualities are needed to do this job? Characteristics must be such that the insulation can safely meet the demands imposed upon it in operation. Some important qualities that the insulation must have include: 1) flame retardance, 2) low moisture absorption and good dimensional stability, 3) low time-temperature deterioration rate, 4) resistance to arc tracking and carbon tracking, and 5) impact resistance.

For molded parts, polyester-glass is outstanding in all the above electrical and mechanical properties. In addition, its moldability or ability to achieve strength with low weight, low post-mold shrinkage for close dimensional tolerances, faster cure for higher production rates, and ability to produce strong, "deep draw" parts make it ideal for application as electrical insulation. The comparative qualities of phenolic materials and polyester glass are outlined in table 1.

Molded Insulation Design Detailed

The characteristics in table 1 are obtained from a molded insulation made by mixing glass fibers, liquid polyester resins, additives (which are usually fine inorganic powders), pigments, and catalysts which convert the liquid resins into hard, thermosetting plastics. Under heat and pressure, the mixture hardens (cures) to form a strong insulating material. By the use of molds a variety of shapes to fit various needs is obtained. Structural shapes are easily obtained from flat stock that is sawed, drilled, punched, or preformed into channels or angle stock. Samples of both molded and structural shapes are shown in figure 2.

For switchgear, a base molding was designed to house and support the stationary disconnect stud, as shown by transparent moldings in figures 3 and 4. Two base molding designs were used for the three phases on the bus side while a "single-barrel" design was used for the center phase, and all three phases utilize a "double-barrel" design and are identical except that one is inverted.

Other molded parts used for switchgear include the primary stud support for 4.16-kv circuit breakers. The three moldings used for each breaker eliminate the use of grounded materials in this high current area. Molded parts are also used to mount the secondary disconnect contacts, which are attached to the stationary cubicle. In addition, the post-type bus isolators and the stand-off insulators are molded around proper tapped metal connectors.

In controller construction, molded parts are applied as supports for the power fuses, primary contact supports, and cubicle-mounted primary disconnects. Figure 5 shows the primary contact support mounted on the drawout element.

The molding held by the model in figure 6 performs five separate functions—1) it is an insulator; 2) it supports the load cables; 3) it serves as a shutter support; 4) it mechanically mounts the stabs for primary disconnects; and 5) it contains inter-phase barriers. This molding made a plug-in feature possible in a 32-inch depth.

In the fuse area, these moldings provide a barrier between the fuses and the arc chutes, mechanically mount the fuse clips, electrically isolate one phase from the next, and provide adequate creepage in just 1½ inches of height. Figure 6 shows just how essential these moldings were in limiting the controller height to 45 inches.

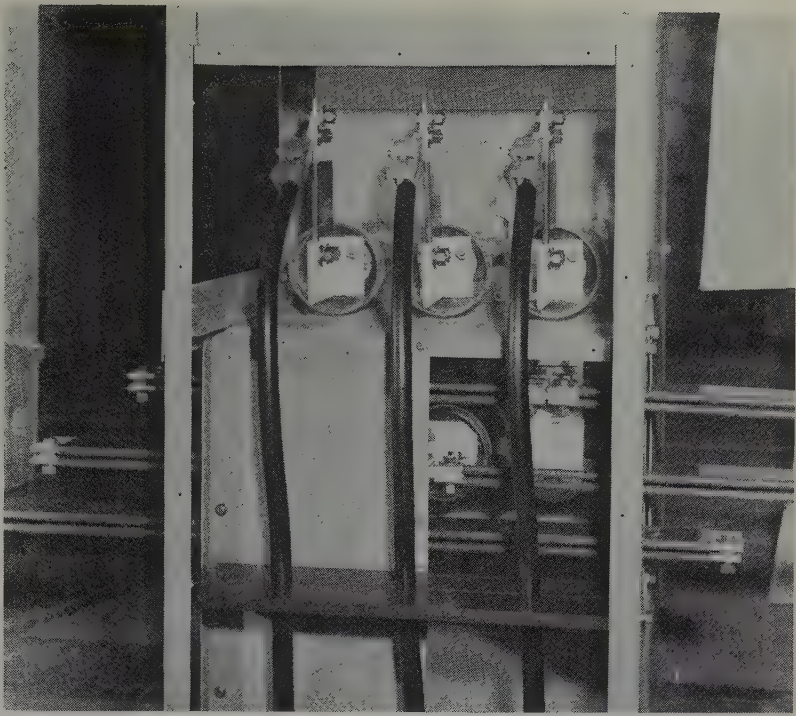

Figure 4, molding designed to house and support the stationary disconnect stud, as shown by transparent moldings.

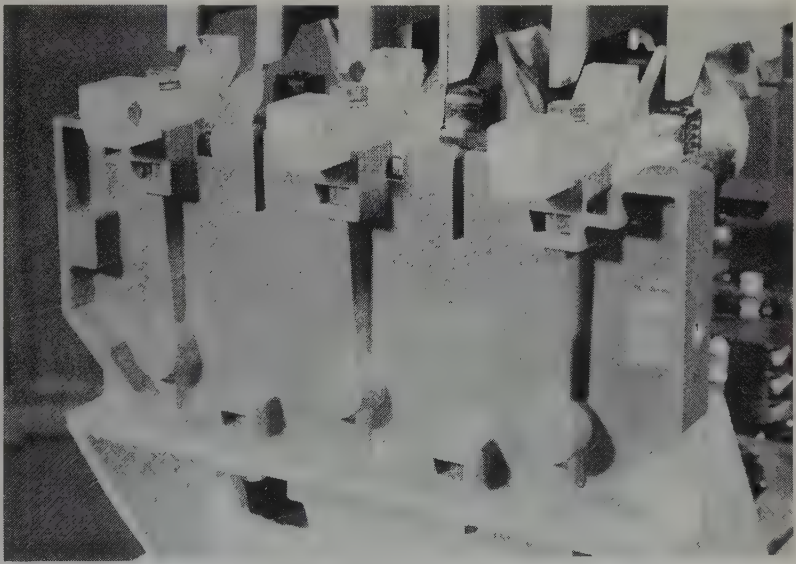

Figure 5, type 456 air break contactor—closeup of line side molding and stationary contacts.

Application of Flat Sheet Stock Insulation Described

Flat sheet stock insulation is used in a variety of ways, both as intercompartment barriers and as preformed structural shapes. Inter-unit phase barriers provide the most common application for the flat sheet while the punched sheet is used to separate bus runs in metal-enclosed housings such as load break switches and low voltage switchgear.

Structural shapes are also used to support bus runs, small thermal breakers, metering equipment, and the like. The angle-formed structural shape is finding greater application as paper base phenolic insulations are replaced. Channel stock can effectively provide the proper insulation and added strength when used as a cover

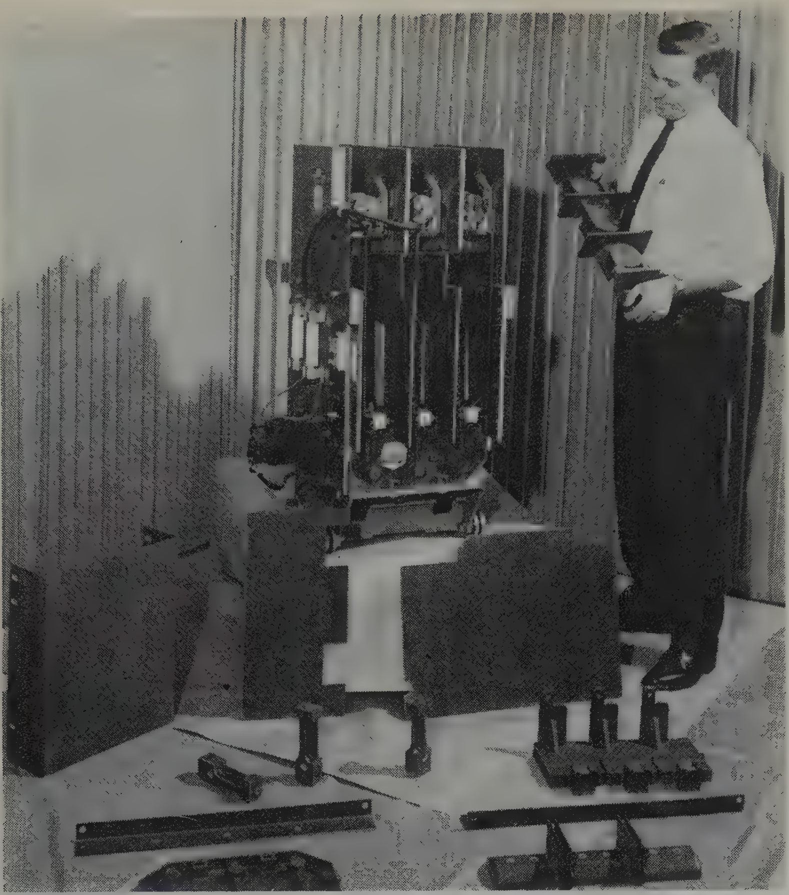

Figure 6, molding held by model acts as an insulator, supports load cables, serves as shutter support, mounts stabs for primary disconnects, and contains inter-phase barriers.

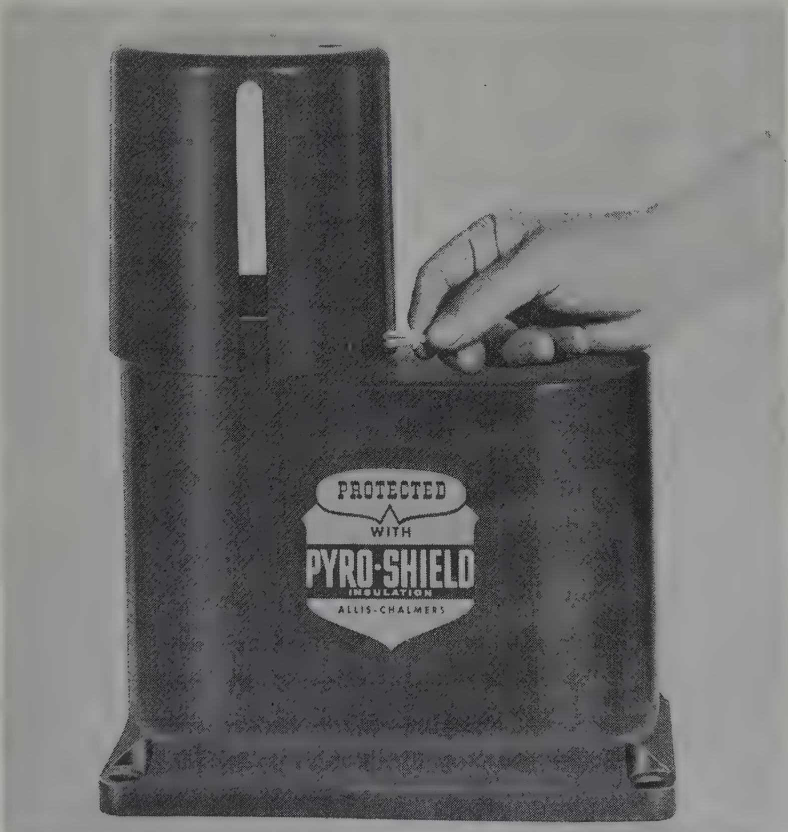

Figure 7, two-piece bus insulation joint—molded base and cap are locked together with nylon pin.

over steel support structures. Polyester-glass is also made into a solid square rod shape for push rod applications such as for remote operations of shutter blades, switches, and doors. This form is presently used to raise and lower the shutter bars which cover the primary disconnect openings in metal-clad switchgear and in drawout load break switch cubicles.

Flat sheet insulation was applied to the controller by using the new track resistant, flame retardant glass polyester in the form of inter-phase barriers and as structural angle-forms. Shrouds and side sheets were also made of sheet insulation. Flat sheet parts, molded (laminated construction) angles, as well as premix molded parts are shown in figure 6.

This insulation contains a chemical mechanism that increases its carbon tracking resistance up to 1000 times that of phenolic materials. Cubicle mounted shutters are made of polyester-glass with holes punched to allow insertion of the primary disconnects. When the carriage is racked to the disconnect position, positive action of the shutter completely isolates primary live contacts.

Convenience of operation is the initial benefit derived from the progressive change to molded polyester-glass. The molded base and close fitting cap, shown in figure 7, are locked together by a removable nylon pin. This articulate base and cap system presents a two-piece bus insulation joint that is clearly understood by maintenance personnel and leads to operator peace of mind.

Interchangeability of parts is the natural result of using premix molded glass-polyester in precision matched-metal molds. This is comparable to the precision of die-cast aluminum or zinc parts compared to sand-cast parts. In addition, polyester-glass is lightweight, clean, and easy to store and all parts are re-usable after every disassembly.

Factory quality maintenance is consistently attained in the field by operators who understand the simpler fabricating material. They make fewer errors, and do their work in less time. The added reliability of polyester-glass insulation is a distinct advantage to users who are unable to nspect primary bus insulation as ften as they would like. Increased rotection in the area of primary disconnects and bus joints is inherent with the use of molded insulation. High impulse strength is achieved in a minimum of space.

Greater economy is realized for several reasons. For instance, cost of maintenance is reduced because of the simple construction; both installation and inspection are easily accomplished and all parts are re-usable.

Operating Experience Proves Reliability

Maximum reliability results from these superior insulation qualities. For example, water absorption rate is an important consideration inasmuch as high humidity cannot be avoided at installations in many areas. Years of operating experience have shown that when the absorption of moisture is held below approximately one percent, as measured by the ASTM 24-hour test, the reliability of the material is not noticeably impaired. Typical rates, as shown in figure 8, are one percent for phenolic compounds and one-half of one percent for polyesters.

Another measure of reliability and/or security is the high flame retardance that is provided. Because switchgear and all electrical equipment must be designed to avoid the possibility of fire, flame-retardant materials are utilized to limit fire damage in the event a fire should break out. Polyester-glass containing the alumina additive or made with a chlorinated resin are flame retardant; that is, they will extinguish their flame when the source of the flame is removed. Again, reference to figure 2 will show the relatively high flame retardance maintained by the polyester-glass insulation.

High impact strength is also a plus feature of molded polyester-glass insulation. Parts of an electrical assembly are sometimes subjected to severe shock forces caused by heavy currents flowing in conductors during a short circuit. All of the supporting insulation parts must withstand these forces without mechanical damage.

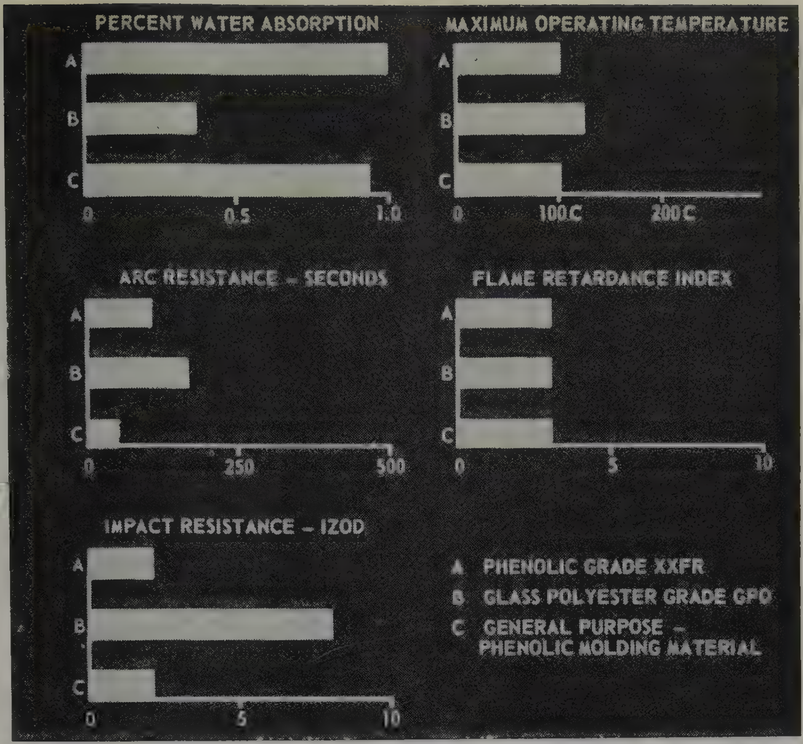

Figure 8, characteristics of polyester-glass insulation are compared to phenolic materials commonly used for switchgear insulation.

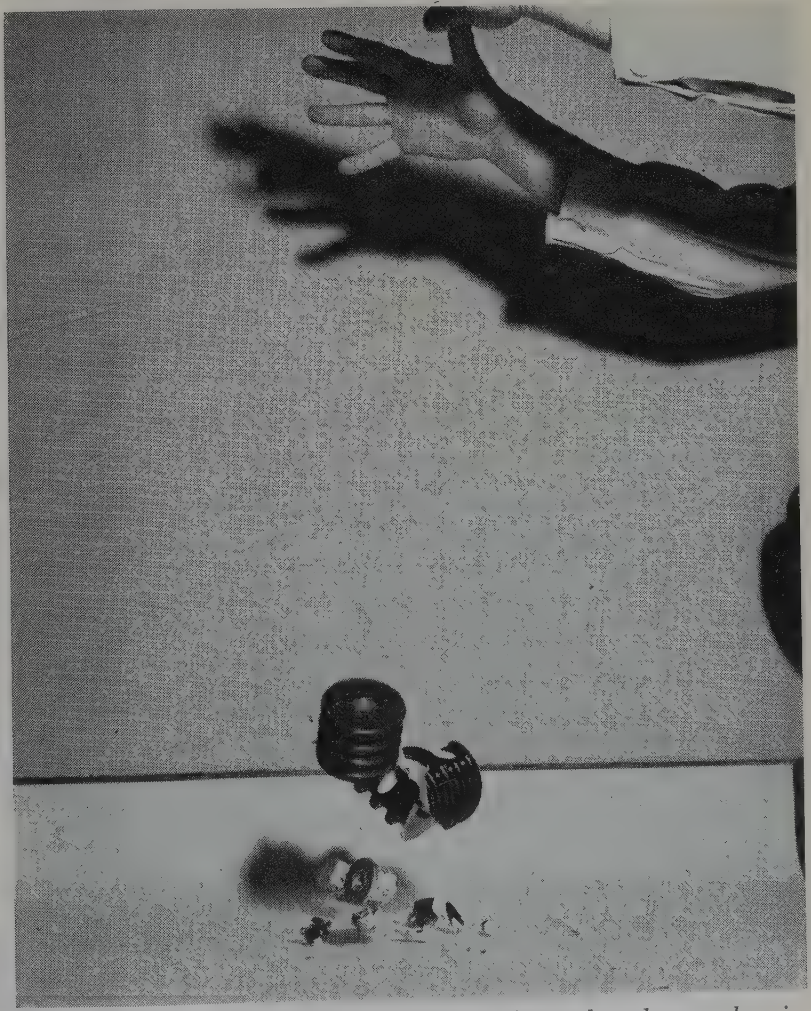

Figure 9, porcelain insulator shatters when dropped; polyester-glass insulator merely bounces.

Polyester-glass materials exhibit an impact strength of from 2 to 6 ft lbs for molded parts and 8 to 10 ft lbs for laminates. Porcelain impact resistance is approximately ½ ft lb. In addition, under thermal cycling porcelain will chip or spall while polyester-glass will not. The use of polyester-glass also minimizes the risk of damage from shipping abuse. The customer is assured of an impact strength five to six times as great as comparable phenolic insulation.

Figure 9 illustrates the high impact strength of the polyester-glass as compared to porcelain. This stroboscopic photograph was taken just after two insulators, one of porcelain and one of polyester-glass, had been dropped. Note that the porcelain insulator shattered into many fragments, while the polyester-glass simply bounced.

Exceptional carbon tracking resistance keeps tracking to a minimum. The condition of tracking, or formation of a conducting carbon path on the surface of insulation due to an arc traveling across the surface, could be caused by excessive dust, moisture, high impact shock, etc. The possibility of tracking increases with voltage and becomes a serious problem at the higher voltages. Polyester-glass exhibits a high arc-tracking resistance, as shown by table 1; the relative insulating value is 20 to 25 times as great in comparison with phenolics. This again is due to the use of inorganic compounds in the insulation. In the compound using hydrated alumina filler, when subjected to a hot arc the filler gives off water which in turn decomposes to hydrogen and oxygen. The oxygen then combines with carbon which may have been formed to make carbon monoxide or carbon dioxide gas which is readily discharged as a free gas. Thus, the alumina serves as a carbon removal mechanism.

Because the permissible operating temperature of inorganic base materials is higher, the life expectancy of polyester-glass material can be expected to be greater than phenolics at the same operating temperatures. The increase in life is approximately 25 percent. Dielectric strength is twice as good after heat application to both phenolics and polyester-glass. Greater life of a material represents dollar savings in investment over a period of time.

The modern, functional (both flat sheet and molded) design of polyester-glass insulation takes full advantage of its superior qualities, and the end result is that larger blocks of power can be handled in a more limited cubicle size.

Of course, reliability and maximum protection provided with molded plastic insulation even under the most severe operating conditions are extremely important. In addition, however, extra operational features inherent in the system have been made to simplify installation, increase ease of operation, lengthen the life of the equipment, and increase operator safety. These features are helping to bring about a new concept in electrical standards of insulation.

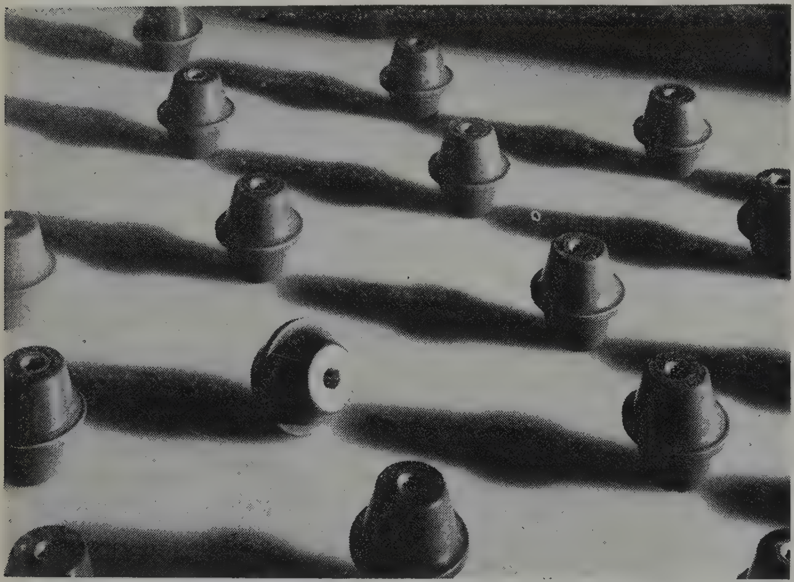

Figure 10, post-type glass-polyester insulators used on low voltage switchgear as bus isolators and for phase-to-phase separation.

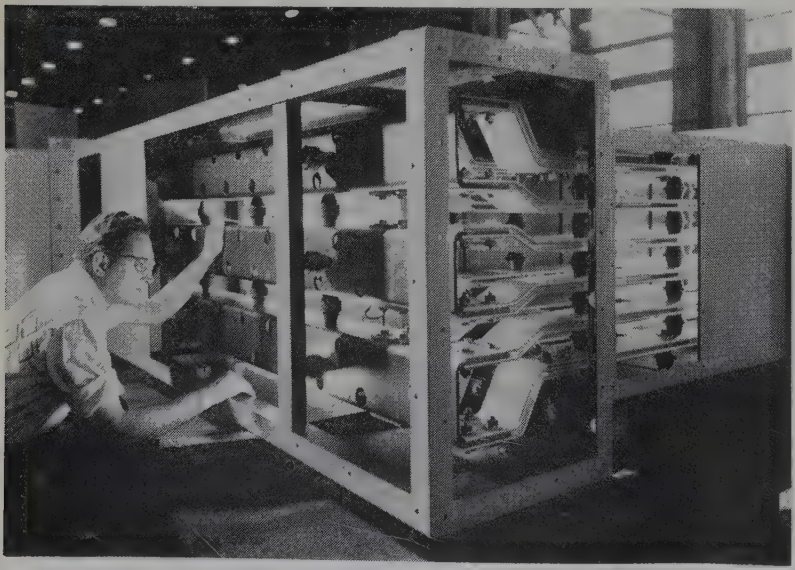

Figure 11, corner section of 4500-amp, 600-volt bus duct used to connect an outdoor transformer to a load center substation serving station auxiliary equipment. All post-type insulators are glass-polyester.

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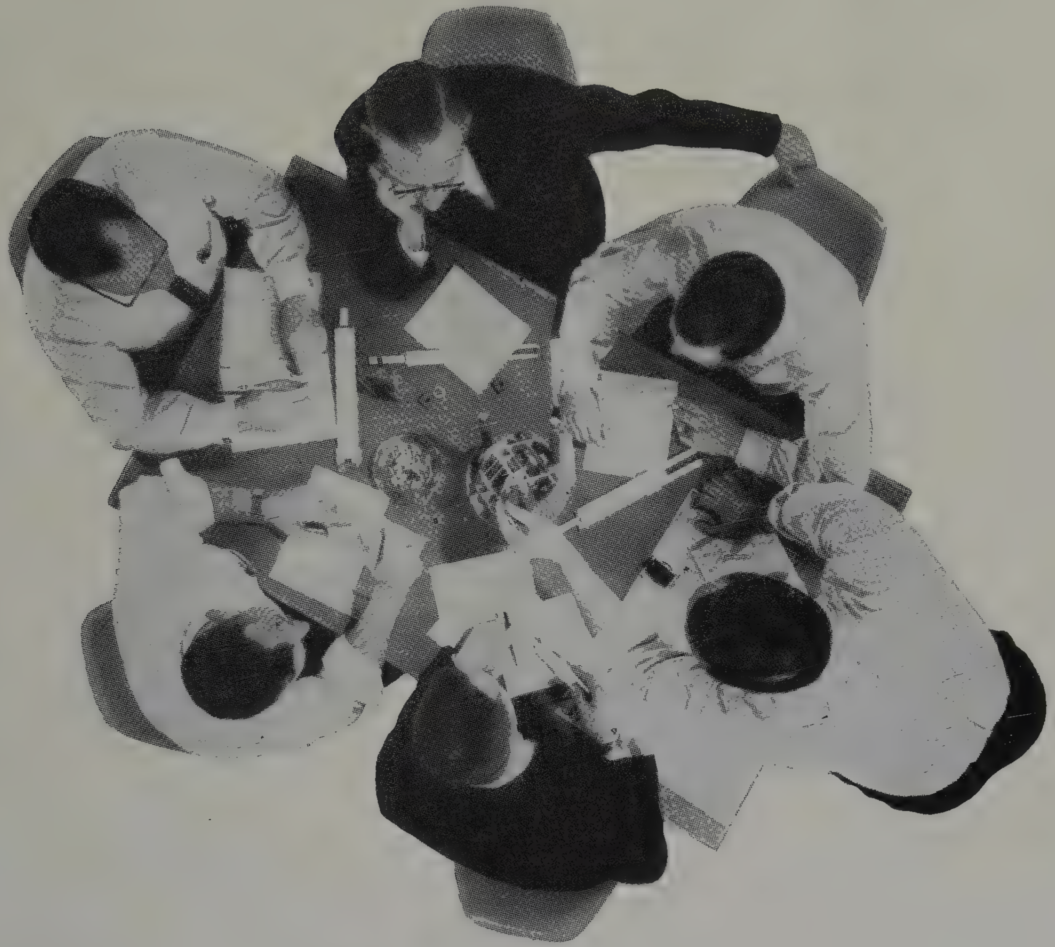

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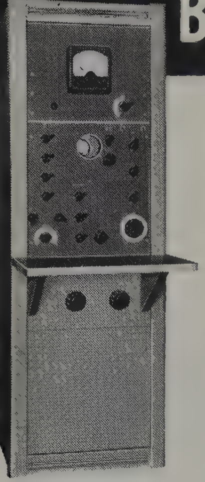

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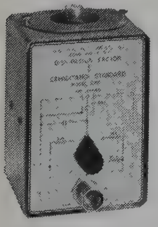

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Industry News

George Spencer Inc., Minneapolis, Minn., has been appointed a distributor by *Corning Electronic Components*, Bradford, Pa.

Ceramics International Corp., Mahwah, N. J., has appointed two East Coast representatives: *Melville Grant Associates*, Needham, Mass., for the New England states, and *William Mills*, Madison, N. J., for the New Jersey and metropolitan New York territory.

Andrew Gilchrist Ltd., St. Laurent, Que., Canada, has been named authorized sales representative for *The Macallen Co. Inc.*, Newmarket, N. H.

The Zippertubing Co., Los Angeles, has appointed *Valley Electronics*, Towson, Md., a distributor in Maryland, Washington, and Virginia.

New sales representatives appointed by *Times Wire & Cable*, division of *International Silver Co.*, Wallingford, Conn., include: *W. R. Griffin Co.*, Springhouse, Pa.; *Inland Associates*, Mission, Kan.; *Perrott Associates*, Orlando, Fla.; *H. G. Pretat & Co.*, Chicago; *Southeastern Sales Co.*, Winston-Salem, N.C.; *Tec-Sel*, Huntsville, Ala.; *J-H Electronic Sales Co.*, Towson, Md.; *George Davis Sales Co.*, Los Angeles; and *Leroy Beier*, Chicago.

American Micro Devices Inc., Phoenix, Ariz., was recently formed to manufacture silicon semi-conductor devices for the military and commercial computer and electronics market.

The Cinema Div. (Burbank, Calif.) of the *Aerovox Corp.* has been merged into the *Hi-Q Div.* Former Cinema general manager Harold Miller is now vice president of plant operations for Hi-Q.

The *Silicone Products Dept.*, *General Electric Co.*, has moved its Michigan sales office from Detroit to Oak Park. New distributors for G-E RTV silicones are: *Electrical Specialty Co.*, San Francisco, Calif.; *Federal Insulation Co.*, Chicago; *Insulation and Copper Sales*, Detroit, Mich.; *Smooth-On Manufacturing Co.*, Jersey City, N.J.; and *Punt Inc.*, Floral Park, N.Y.

Lukko Sales Corp., Chicago electronic distributor, has been reorganized and is under new management. Sanford Levey is president, S. Robert Berk is vice president, and Sol W. Berk is chairman of the board.

The board of directors of *Loral Electronics Corp.*, New York City, has approved acquisition of *American Beryllium Co. Inc.* and its subsidiary operations, *United States Beryllium Corp.* and *Visioneering Co.* (*U.S. Beryllium Corp. of Colorado*, a mining company, is not involved in the deal.) Also, plans for the acquisition of *Accurate Specialties Co.* by Loral have been terminated by mutual agreement.

Beauchaine & Sons Inc., Lakeport, N.H., continues to manufacture and sell electronic service tools formerly made for and sold under the CBS trademark.

Technology Associates, Santa Monica, Calif., manufacturers representative specializing in RF, microwave, and instrumentation, has been purchased by Mel Marcus and Dave Smith, formerly with *Hamilton Electro Sales.*

The Ashtabula, Ohio, research and testing laboratories of the *Molded Fiber Glass Companies* are now available without charge to aid customers in materials selection, product design, and quality control.

The *Connecticut Hard Rubber Co.*, New Haven, Conn., has appointed *Prehler Electrical Insulation Co.*, Chicago, as distributor for its silicone rubber insulating tapes.

New West Coast sales representative for ceramic-to-metal products produced by *Ceramics International Corp.*, Mahwah, N.J., is the *J. W. Marsh Co.*, Los Angeles.

Canadian Allis-Chalmers has transferred all electrical production from St. Thomas, Ontario to Lachine, Quebec.

F. J. Stokes Corp., Philadelphia, has appointed Walsh Associates, Seattle, to handle sales of its plastics production equipment in Washington, Oregon, and Alaska.

Cables insulated and jacketed with Bakelite vinyl link the IBM 1401 Data Processing System with auxiliary equipment. These cables, which permit flexibility of operation, are manufactured by Brand-Rex Division of American Enka Corp., Concord Mass.

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Association News

AIEE Names Two 'Fellows' For Work in Insulation

Among 17 members of the American Institute of Electrical Engineers recently elevated to the grade of Fellow were two who were honored for their contributions in the field of insulation. They are: Harrison R. Armstrong, Detroit Edison Co., Detroit, Mich., "for contributions to insulation coordination and transient over-voltage protection"; and Earl S. Condon, Earl S. Condon Co., Los Angeles, Calif., "for contributions to power insulator improvements and protective and distribution equipment for aircraft."

NEMA Insulating Materials Division Re-Elects Officers, Plans Luncheon

The Insulating Materials Division, National Electrical Manufacturers Association, has re-elected the following officers: E. R. Perry, National Vulcanized Fibre Co., chairman; D. J. O'Conor Jr., Formica Corp, vice chairman; and R. L. Westbee, Minnesota Mining and Manufacturing Co., vice chairman. L. N. Smith, New Jersey Wood Finishing Co., was elected to the board to represent the Flexible Electrical Insulation Section.

The Division has also announced plans to sponsor a luncheon at the fourth Electrical Insulation Conference at the Shoreham Hotel, Washington, D.C., February 20, 1962.

Interesting Papers Scheduled for WESCON Technical Program

Among some of the many papers scheduled to be presented at the technical program of the Western Electronic Show and Convention in the Cow Palace, San Francisco, on August 22-25, are the following: Engineering Problems in Establishing a Thin Film Circuit Manufacturing Capability, by J. C. Gioia, Light Military Electronics Dept., General Electric Co.; Redundancy and the Detection of First Failures, by D. C. James and A. H. Kent, The Martin Co.; Use of the Weibull Distribution Function in the Analysis of Multi-variate Life Test Results, by A. A. Procassini and A. Romano, Motorola Inc.; KEWB—A Radiation Burst Test Facility, by W. M. Haussler, Atomics International; Thermal Characteristics and Time-Temperature Studies of Miniature Electrical Connectors, by C. Dean Stephenson, Amphenol-Borg Electronics Corp.; and Transient Radiation Effects in Capacitors and Dielectric Materials, by H. W. Wicklein and R. H. Dickhaut, Boeing Airplane Co.

Larsen Heads EASA

George Larsen, Larsen-Hogue Electric Co., has been installed as international president of the Electrical Apparatus Service Association Inc., succeeding J. Arthur Turner Jr. Also installed as national officers for the 1961-1962 term, were: Vice-president Ben J. Horton, The Atkinson Armature Works; Secretary, Thomas M. Paul, Paul Electric Co.; and Treasurer (re-elected), Alex A. Shovan, Industrial Electric Service.

SPI Tells Plastics Standards Story in ASA Conference, Oct. 10-12

On Wednesday morning, October 11, the story of plastics standards work will be told under the sponsorship of The Society of the Plastics Industry at the American Standards Association's 12th National Conference on Standards, scheduled for Houston, Texas, October 10-12, 1961. Papers to be presented there will explain: Who Writes Plastics Standards; How These Plastics Standards Serve U. S. Industry . . . and The U. S. Government; and International Standards for Plastics. Following, on the same morning, a session will be held on the state of the art of standardization affecting shipping and transportation.

New SPI Prepreg Division Officers

John L. Stief, Coast Manufacturing & Supply Co., and H. J. Ried, Standard Insulation Co., have been elected chairman and vice chairman, respectively, of the Prepreg Division of the Society of the Plastics Industry Inc. Stief succeeds Grant Brown, Cordo Chemical Co., first chairman and organizer of this Division.

New EIA Officers

The Electronic Industries Association has elected L. Berkley Davis, General Electric Co., president for a second term and re-elected Leslie F. Muter treasurer for the 26th year.

Re-elected senior vice president was Robert S. Bell, of the Consumer Products Division; and as vice presidents S. R. Curtis, for the Military Products Division; William S. Parsons, for the Parts Division; and Ben Adler, for the Industrial Electronics Division. George W. Keown, Tung-Sol Electric Inc., was elected both vice president and chairman of the Tube and Semiconductor Division.

Chairmen of EIA's four other product divisions were also re-elected. They are: Consumer Products Division—Edward R. Taylor, Motorola Inc.; Military Products Division—L. L. Waite, North American Aviation Inc.; Industrial Electronics Division—C. Russell Cox, Andrew Corp.; Parts Division—W. Myron Owen, Aerovox Corp.

Two new directors were elected. They are: G. B. Mallory, P. R. Mallory & Co. Inc., for the Parts Division, and L. M. Sandwick, Pilot Radio Corp., for the Consumer Products Division.

Executive Vice President James D. Secrest was re-elected for his 12th term, and General Counsel John B. Olverson for his third.

Two new departmental directors were elected. W. Gerard Tuttle, American Bosch Arma Corp., was named head of the Industrial Relations Department, and Thomas P. Collier, Motorola Overseas Corp., chief of the International Department. Re-elected were F. R. Lack as director of the Engineering Department, Frank W. Mansfield, Sylvania Electric Products Inc., as head of the Marketing Data Department, and C. Paul Young, Philco Corp., as director of the Military Relations Department.

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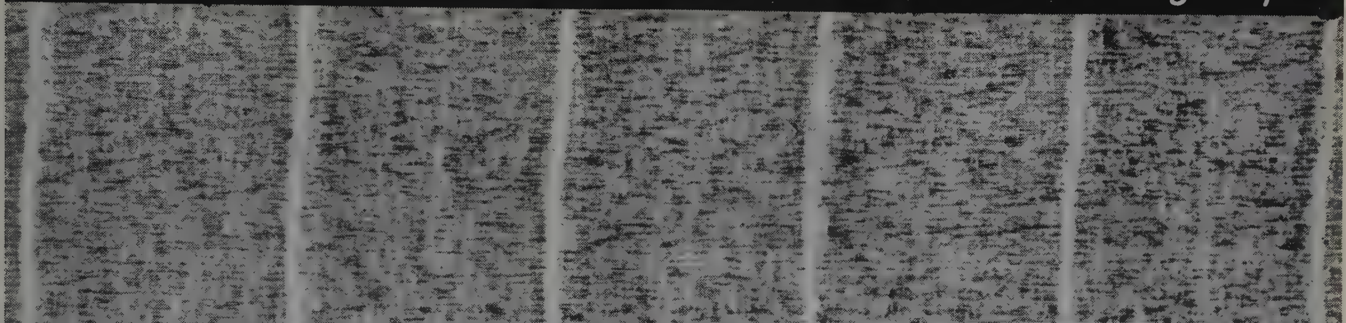

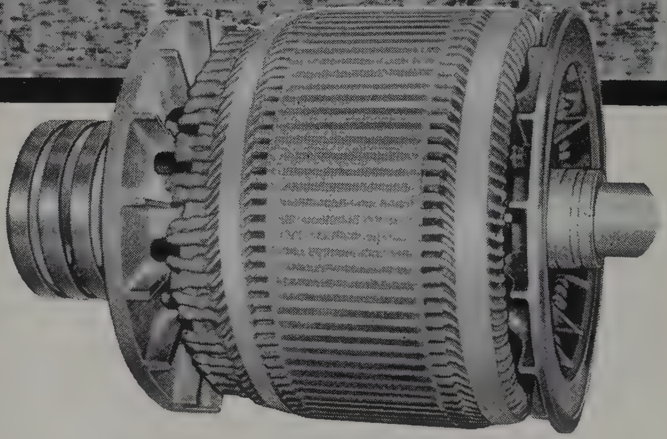

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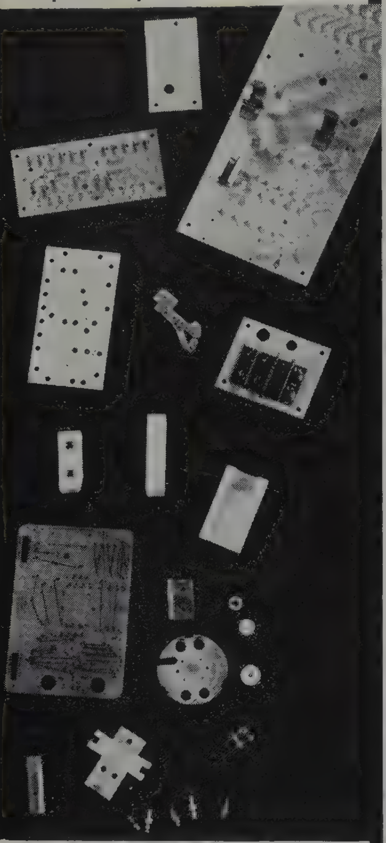
• terminal boards • standard and special terminals • fabricated plastic parts • engraved or silk screen panels • punched parts • special plastic assemblies



One of the industry's leading suppliers, Emmco Plastics Corporation can produce high-quality fabricated plastic parts tailored to your specific electrical or electronic application. A complete staff of skilled personnel, modern manufacturing facilities and rigid quality control procedures enable Emmco to provide fabricated components... in quantity, to close tolerances, at low cost.

FOR MORE INFORMATION on Emmco's capabilities and products, write for free descriptive bulletin, Handy Materials Guide, and Design Specification Sheet. Emmco's Sales Department can also furnish price information or technical assistance on a specific application. Send us your prints for prompt quotations.

301-2

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PLASTICS CORPORATION
68 VINE STREET, EVERETT, MASSACHUSETTS
DUnkirk 9-1660 TWX: Ever-Mass-152

Print Ins. 22 on Reader Service Card

Terminal Board for Guidance Device Resists Heat and 30 G's

Terminal board for mounting the mica capacitors of the Model 2013J Stable Platform, a device vital to missile-rocket guidance made by Lear, Inc., Grand Rapids, Mich., must be a dimensionally stable material, withstand soldering temperatures (450 to 500°F) without loosening of terminals, and resist shock, vibration, and environmental extremes while permitting a lightweight design.

The board is formed from glass cloth bonded with a silicone resin. It is manufactured by Silicone Insulation, Inc., Bronx, N.Y.

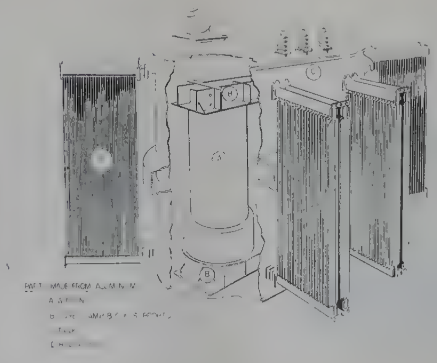
Environmental conditions in this application are: —40 to 160°F; shocks of 30 G's for about 11 milliseconds each; complex wave vibration for about 20 minutes in each plane as follows — 30 to 100 cps: $0.46G^2$/cps and 100 to 2000 cps: $0.015G^2$/cps.

All-Aluminum Transformer

Conceived as a prototype of the standard power transformer of the future, the 20,000-kva unit shown was fabricated with all aluminum electrical and structural parts for the Aluminum Co. of America by General Electric Co. as part of a joint development project.

The transformer has been installed in a substation at the Alcoa plant in Massena, N.Y., and is being used for voltage step-down from 115,000 volts to 13,800 and 6,900 volts, serving the division's fabricating operations.

Constructed of aluminum—except for the magnetic core, interconnecting cables, and insulating parts—the three-phase, wye-to-delta transformer employs an all-welded aluminum tank, aluminum core clamps, and aluminum radiators. Its winding structure incorporates aluminum foil in the high side and aluminum wire in the low side.



Better transient voltage characteristics, obtained through the use of aluminum foil instead of wire for high-voltage windings, was cited by both companies as the prototype's chief electrical advantage.

Mechanical advantages said to result from optimum use of aluminum in power transformers, compared with conventional materials, were more efficient heat exchange, increased corrosion resistance, reduced maintenance costs, and potentially lower material and manufacturing costs. Eventual savings in transformer construction costs are expected because the aluminum foil windings can be manufactured using highly automated techniques. In addition, aluminum's highly efficient heat transfer properties and natural resistance to corrosion are expected to permit design economies and maintenance savings.

Ceramic Capacitors Comparable to Paper and Film Units

A major breakthrough in the design and construction of ceramic capacitors is said to have resulted in a new, rolled ceramic capacitor for use in the extremely high capacitance range of paper and film dielectric units. "Cerol" capacitors reportedly feature small physical sizes and superior electrical characteristics. They are designed for general applications in bypass-coupling, filtering, and blocking circuits, and for critical applications in decoupling and pulse circuits where low series resistance at high frequencies together with extremely small sizes are required. Manufacturer is Hi-Q Div., Aerovox Corp., Olean, N.Y.

Letters to the Editor

Chicago, Illinois

"You have done a valuable service in bringing together the information presented in the June issue, 'Effects of Radiation on Mica.'

"I would like to emphasize that a vital piece of information is missing as you point out in saying . . . 'in most of the studies no attempt was made to distinguish the different types of mica . . .'

"Although as a group of materials the micas are relatively radiation-resistant, as compared with the organics, it can be expected that there would be significant differences among the micas. For example, muscovite is less resistant to heat than is phlogopite, and resistance to heat is very roughly related to resistance to nuclear radiation in a comparison among various materials. Synthetic mica, fluorphlogopite, could be more radiation-resistant than the natural micas because it could be produced with a minimum of impurities which could be sources of radiation damage.

"As you well know, with muscovite mica being used in such a large percentage of applications, one could assume that the data in your table probably applies to muscovite mica when no type is indicated.

"I continue to find *Insulation* interesting and helpful."
—R. A. Humphrey, Ceramic Engineer, Armour Research Foundation of Illinois Institute of Technology.

Sharon, Pennsylvania

"I would like to add my comments on your proposal for more and better insulation education.

"Of course we cannot be opposed to more and better education in any useful subject. The difficulty is that there are so many of these subjects that the competition for the time of the student and the schools requires that most of them have to be left out of the formal education of an engineer.

"In my opinion, the colleges must necessarily concentrate on the basic courses which will provide a foundation for knowledge that the engineer will use 15 years and longer after his graduation. Non-basic courses, such as a course in insulation would surely be, have a tendency to be obsolete before they are given.

"There are basic aspects to insulation, of course, but I feel that they are already a part of basic courses which are now available to the student electrical engineer, if he has the time left after taking even more basic courses. Some of these which I feel would help an insulation specialist as well as engineers entering other fields are:

Functions of a Complex Variable
Vector Analysis
Organic Chemistry
Atomic Physics
Solid State Physics

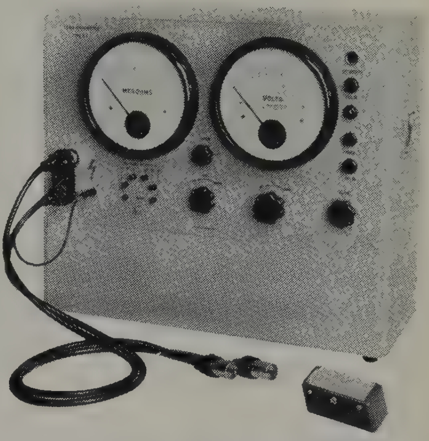
"Our engineering educators, I am sure, could make up a better but similar list. In addition, there is certainly a need for more liberal arts courses.

"Although I disagree with your proposal on education, I wish to say that the same enterprise and interest in insulation which has led to this proposal has also resulted in a very fine magazine which I value highly."
—J. H. McWhirter, Development Engineer, Power Transformer Department, Westinghouse Electric Corporation.

Inductive Voltage Divider Calibration

The National Bureau of Standards has recently improved its services for the calibration of inductive voltage dividers. With the aid of special capacitance bridges, extremely accurate calibrations are given for this type of device. Inductive voltage dividers can be calibrated at NBS by comparison with the standard. The comparison method is simple and should find widespread application in many other standardizing laboratories.

INSULATION
MEASUREMENTS
TO
5000 T ohms



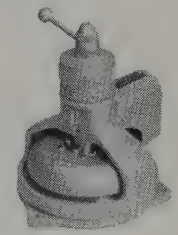
and to 1000 Volts
TERAOHMMETERS

Designed for high accuracy resistance measurements, these Richard Jahre instruments cover the range 2 Megohms to 5000 Teraohms (5 x 10^{15} ohms) at potentials up to 1000 volts. A single electrometer tube insures maximum stability; leakage is eliminated by guard-ring technique; and accuracy is exceptionally high, due to the use of two large hand-calibrated meters for the measurement of test voltage and insulation resistance.

APPLICATIONS

Testing:
- Insulation of components, capacitors, transformers, cables, wires, etc.
- Insulating materials such as plastics, glass, ceramics, oils and varnishes.
- Purity of liquids

Determining:
- Voltage coefficient of materials and components.
- Temperature coefficients.
- Surface conditions.
- Leakage resistance of capacitors.
- Surface resistance of printed circuits.
- Moisture content of insulating materials.



Special sample holders are available for measuring the insulation resistance, dielectric constant, and dissipation factor of materials in sheet form, as liquids, or as wire insulation.

WRITE FOR ADDITIONAL INFORMATION

ROHDE & SCHWARZ

111 Lexington Ave., Passaic, N. J.
PRescott 3-8010
Print Ins. 23 on Reader Service Card

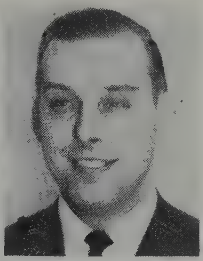
People in the News

John E. McBrian has joined Mosler Research Products Inc., Danbury, Conn., as engineering manager.

James M. Jans, General Chemical Div., Allied Chemical Corp., Camden, N.J., has been promoted to chief engineer. Four newly created positions will be filled by: *Robert G. Bierbower*, manager of engineering administration, *John L. Ciba*, manager of design engineering, *Charles W. Gaylord*, manager of process engineering, and *James Jaffe*, manager of process engineering.

R. J. Westcott has been appointed plant engineer at Anaconda Wire & Cable Co., Hastings-on-Hudson, N.Y., and *R. E. McIlvane* has been promoted to manager, Communications Products Div.

R. E. McIlvane



D. Hodowanetz

David Hodowanetz has been named sales manager of the insulating materials section, Micarta Div., Westinghouse Electric Corp., Hampton, S.C. He succeeds *J. G. Wynn*, who has become manager of the liquid insulating materials plant in Manor, Pa.

Loral Electronics Corp., New York City, has appointed *Dr. Lawrence F. Jones* as staff scientist.

At Toledo, Ohio, Johns-Manville has appointed *Edward J. Bodette* as staff manager, electrical and industrial yarns, and *Charles F. Briggs* as sales representative in the Atlanta, Ga. territory of Johns-Manville Sales Corp.

James J. Clerkin, Jr. has been elected president of General Telephone & Electronics International Inc., New York City, a subsidiary of General Telephone & Electronics Corp. He succeeds *Gene K. Beare*, who was recently elected president of Sylvania Electric Products Inc., another GT&E subsidiary. *Melbourne J. Myers* has been appointed manager of the USD-7 program for development and design of airborne electronic equipment at the Mountain View operations of Sylvania. At Needham, Mass., *Martin Cooperstein* has been named manager of the programming and analysis laboratory, and *Edward W. Jervis Jr.* has been made manager of the Mobile Digital Computer program office of the Data Systems Operations. *George E. O'Rourke Jr.* has been appointed manager of the systems research department and *Dr. Harold Raemer* has been named physics specialist at the Applied Research Laboratory in Waltham, Mass. Also at Waltham, *Allen J. Lovenstein* has been appointed manager of the Advent satellite communications program.

Dr. Lewis M. Branscomb, chief of the Atomic Physics Div. at the National Bureau of Standards, Washington, D.C., has been awarded the U. S. Dept. of Commerce Gold Medal for Exceptional Service.

Louis B. Allen has been appointed manager, materials evaluation for IBM Corp., Endicott, N.Y.

At Princeton, Ind., *C. R. Stone* has been promoted to director of production of Potter & Brumfield Div., American Machine & Foundry Co.

Gene E. Lewis has been appointed manager of marketing and engineering of General Electric Co.'s Holyoke, Mass., high voltage specialty transformer section. The following appointments to shop manager have been made in the Apparatus Service Shops Dept.: *Thomas M. Hushen*, New York; *Dee P. Patterson*, Salt Lake City; *Robert R. Bracchi*, Indianapolis; *Daniel M. Capito Jr.*, Louisville, Ky.; and *H. P. Bertoulin*, Birmingham, Ala. *Charles S. Martin* has been appointed midwestern sales manager of G-E's Insulating Materials Dept. with offices in Ft. Wayne, Ind.

Milton R. Stohl has joined Mystik Adhesive Products Inc., Chicago, as vice president and director of sales and marketing.

M. R. Stohl

H. H. Heyden

Hector H. Heyden, Teflon Wire & Cable Div., Inso Electronic Products Inc., Union, N.J., has been elected vice president in charge of sales engineering.

L. D. Brown has been named chief engineer for Aerotest Laboratories Inc., Deer Park, L.I., N.Y. He will also continue his duties as chief engineer of the Advanced Propulsion Div.

Donald C. McDonald has been appointed vice president, engineering, by Sola Electric Co., Elk Grove, Ill., a division of Basic Products Corp.

Robert B. Ayres has been elected president and treasurer and *Dwight C. Page* was re-elected executive vice president of the Leon J. Barrett Co., Worcester, Mass.

Allis-Chalmers Mfg. Co., Milwaukee, has appointed *Kenneth R. Geist* general manager of the newly formed Special Products Dept. At the West Allis (Wisc.) Works, *James L. Wentworth* has been named purchasing agent, electrical products. The company also appointed three electrical engineers to the Industries Group. They are *Charles B. Anthony*, service superintendent, *Blair D. Dixon*, industrial systems department, and *Robert W. Peterson*, Boston Works.

Roy H. Hainsworth has been named assistant to the director of electrical market sales by Reynolds Metals Co., Richmond, Va.

W. L. Schoonover has been appointed industrial representative for Despatch Oven Co., Minneapolis. His territory will include Georgia, South Carolina and eastern Tennessee.

Free booklet tells you what to look for in a pressure-sensitive tape

Here's a handy, new booklet that gives clear, concise answers to nearly any pressure-sensitive tape problem. It's based on Johns-Manville's long years of experience in the manufacture of tapes for electrical and industrial applications. It's called "How To Select A Pressure-Sensitive Tape," and tells you how to effect important economies; help speed production; eliminate knotty mechanical difficulties. It tells:

- Why the adhesive qualities of a tape are as important as the backing material.
- What causes tape failure; and how to prevent it.
- A glossary of terms associated with pressure-sensitive tapes.
- A complete list of authoritative technical data files available.

JOHNS-MANVILLE
DUTCH BRAND® TAPES
BOX 14, NEW YORK 16, N. Y.

Please send me a free copy of "How To Select A Pressure-Sensitive Tape."

NAME____________________

ADDRESS____________________

CITY______________ ZONE________

COUNTY____________ STATE________

Print Ins. 60 on Reader Service Card

..HIGH VOLTAGE TESTING
of CABLES, MOTORS, GENERATORS and All Electrical Equipment

Mobile D-C HYPOT®

Measures

Dielectric Strength

Insulation Resistance

Dielectric Absorption

Rugged . . Mobile . . for Production, Installation and Maintenance Testing

Output . . 120 kv models provide up to 5000 microamperes d-c. 75 and 45 kv models offer up to 10 ma, d-c.

115v A-C Line . . Input through three-conductor power cord with standard two prong plug and grounding clip.

Self-Contained, Fully Portable . . Single mobile housing with rubber tired wheels and push handle contains metering circuitry and high voltage supply (oil immersed above 45 kv).

Safe, Simple Operation . . Direct reading of insulation leakage current. Fully interlocked, cabinet grounded, output cable shielded . . to protect operator and equipment.

for Every Application . . a HYPOT® Test Set

Heavy Duty HYPOTS®
A-C or D-C, to 150 kv.

Mobile HYPOTS®
A-C to 30 kv, 10 kva
D-C to 120 kv, 10 ma

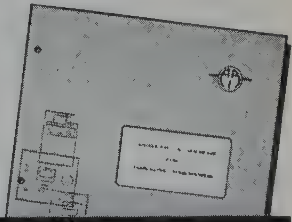
Bench Type HYPOTS®
A-C to 35 kv, 2 kva
D-C to 45 kv, 25 ma

Portable HYPOTS®
A-C to 10 kv, 230 va
D-C to 5 kv, 2 ma

HYPOT® Insulation Materials Tester
Models offer up to 60 kv at 2 kva . . with test fixtures, automatic rate of rise and other controls to meet ASTM, MIL and Federal test specifications.

Write for Manual J-67

"Methods for Insulation Testing
. . Engineering . . Production
. . Maintenance



4-35.6

ASSOCIATED RESEARCH, Incorporated
"Electrical Testing Instruments Since 1936"
3772 W. Belmont Ave., Chicago 18, Illinois

Print Ins. 24 on Reader Service Card

General Electric Silicone dielectric grease

An excellent electrical insulating compound that's easily applied and stays in place.

Water repellency protects terminals, connections from failure due to moisture.

Good heat transfer for transistor applications.

Maintains protection from —65°F to 400°F; won't solidify or evaporate.

Chemically inert.

Protects copper, other metals against corrosion.

For full information on G-E silicone dielectric grease, plus a free 2 oz. sample tube, write on your company stationery to: General Electric Company, Silicone Products Department, Section L Waterford, New York.

GENERAL ELECTRIC

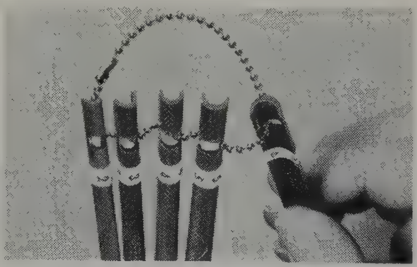
Print Ins. 25 on Reader Service Card

New Materials and Components

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

U-Wedges for Class H Motors

New line of U-shaped stator wedges is reported to have insulating properties that meet the higher overload temperatures in class H insulated motors. The "Vitac" wedges combine fiber glass reinforcement with a new high temperature resin system that provides 180°C performance. Because of the excellent bond between resin and fiber glass, dielectric failure caused by driving damage is stated to be greatly reduced or eliminated.



The one-piece molded construction of resin and woven fiber glass provides high strength and easy driving. Breakage during installation is claimed to be only one-fourth that generally experienced with silicone-glass wedges. Properties are said to equal or exceed those of silicone-glass wedges. Prices per foot range from 23 to 27 cents. Engineering data, prices, and samples are available. The Glastic Corp., 4321 Glenridge Road, Cleveland 21, Ohio.

Print No. Ins. 101 on Reader Service Card

Strong, Lightweight Filament-Wound Reinforced Plastic Parts

Filament-wound reinforced plastic parts are said to be stronger than steel and lighter than aluminum parts. The parts — which exploit the extremely high strength of glass filaments in tension—can be provided in straight tubes, closed end pressure vessels, in tapered or other geometrical shapes, and in almost any size required in current military or industrial applications. Excellent corrosion resistance and dielectric strength are reported. Specific gravity is 2.2. In the direction of the filaments, strength is 200,000 psi. Once formed and cured, the parts can be machined and finished. First used in aircraft and missile applications, the excellent electrical insulating properties of filament-wound parts also suit them for electrical applications such as fuse tubes and similar switchgear components and booms for utility workers on high power lines. Virtually any structure or part requiring extremely high strength-to-weight ratio, and of roughly circular cross section, can be filament-wound. Taylor Fibre Co., Norriston, Pa.

Print No. Ins. 102 on Reader Service Card

High Temperature Dielectric Plastic Film

In electrical and electronic applications, new "Aclar" fluorohalocarbon films are said to have such favorable properties as high volume and surface resistivity, good power factor at high frequency, and low dielectric constant. They reportedly show promise for use in the production of printed circuits, printed cables, electroluminescent panels, and as insulation for capacitors. Other properties claimed are: virtually zero moisture absorption; transparency; good tear strength and abrasion resistance; retention of useful properties up to 390°F and of flexibility down to —320°F; resistance to inorganic acids, alkalies, oxidizing acids, and to most organic compounds; and ability to be vacuum formed, extrusion coated, metallized, and laminated to other films, metals, etc. Allied Chemical Corp., General Chemical Div., 61 Broadway, New York 6.

Print No. Ins. 103 on Reader Service Card

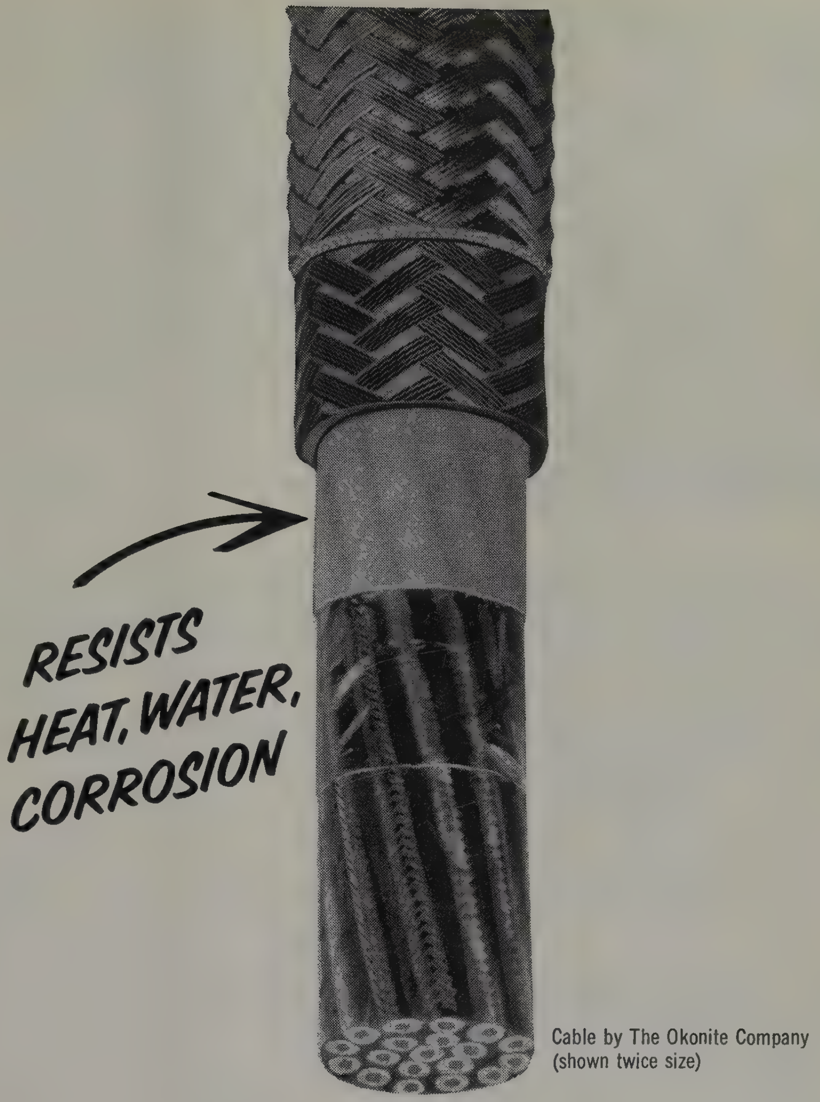
Flexible Epoxy Hardeners

Three new flexible epoxy hardeners permit the production of castings having any degree of flexibility desired over a broad range. No addition of flexibilizer is required to produce epoxy systems from hard, impact types to elastic, rubber-like varieties. The three hardeners, "Bakelite" ZZL-0822, ZZL-0830, and ZZL-0831 are long-chain compounds containing primary amine groups. The hardeners are mutually compatible in all proportions—this allows combinations of the materials to be used to obtain properties intermediate to those offered by the separate hardeners. Softer systems or other extreme variations can be obtained by increasing the amounts of flexible hardener, adding plasticizers, or using modified resins. Other advantages reported include low viscosity and vapor pressure, excellent wetting properties, and convenient pot lives. Epoxy compounds formulated with the new hardeners are said to be stable, no appreciable change in flexibility occurring on aging for one year at room temperature or for 100 days at as high as 140°F. Room temperature cure is generally adequate; but for some properties, improved values can be obtained by post-curing. These flexible epoxy systems are stated to exhibit good electrical properties at ambient temperatures; but in some cases, where loss factors are critical, their use at elevated temperatures is not recommended. Epoxy systems cured with ZZL-0822 offer the best chemical resistance, while those cured with ZZL-0830 have somewhat lower resistance. The new flexible hardeners are recommended for use in potting and encapsulation of electrical components and for laminating and coating compounds. Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 104 on Reader Service Card

Neoprene Splicing Compound for Use Under Electrical Tapes

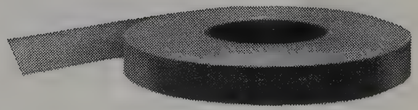
A new neoprene splicing compound developed to fill the need for a highly weather-resistant prime insulation compound is said to give maximum protection against oils, alkalies, and weather extremes. It is designed for use under standard electrical tapes. With a reported tensile strength of 300 lbs/sq in, "Plymprene" exceeds



Cable by The Okonite Company
(shown twice size)

R/M NOVABESTOS® TAPES

...low cost protection
for shipboard cables



These asbestos-glass paper tapes are preferred by cable manufacturers because of their flame resistance and low cost per unit area. Good handling strength assures trouble-free wrapping at high speeds.

In addition to their protective qualities as binder and bedding tapes, they have good dielectric strength. Novabestos tapes are available in a wide range of thicknesses, widths and core diameters and in a variety of asbestos and glass fiber combinations.

For lower first cost . . . less machine downtime during wrapping . . . and better performance on the job . . . talk to the insulating specialists at R/M about the full line of Novabestos tapes. Write for complete technical data.

R M

ASBESTOS TEXTILE DIVISION
RAYBESTOS-MANHATTAN, INC.
Manheim, Pa.
SPECIALISTS IN ASBESTOS, RUBBER, ENGINEERED PLASTICS, SINTERED METAL

Print Ins. 26 on Reader Service Card

for economical design

& manufacture of your product

Coors has cataloged 62 standard terminal insulators for fast, off-the-shelf delivery...lower price!

Many manufacturers incorporate Coors Standard Terminal Insulators into their products, gaining the advantage of these superior insulators plus the advantage of inherently lower costs and fast delivery. Coors Terminal Insulators give you these important advantages: **1.** High dielectric strength. **2.** Excellent surface resistivity. **3.** Great physical strength. **4.** Permanent dimensional stability. **5.** Extreme hardness. **6.** Resistance to high temperatures. **7.** High temperature subsequent brazes. **8.** High thermal shock resistance. **9.** Vacuum tight metal-ceramic assemblies. **WRITE FOR 24-PAGE CATALOG** showing mechanical and electrical specifications for Coors Standard Terminal Insulators. Also included in this catalog is data on special assemblies and the design of ceramic-to-metal seals. **COORS ENGINEERING SERVICE**—A Coors Field Engineer is near you to give you ceramic design help on Coors Standard Insulators or custom ceramic-to-metal assemblies. Call today. REGIONAL SALES MANAGERS: WEST COAST, *William S. Smith, Jr., EM 6-8129, Redwood City, Calif.;* MIDWEST, *John E. Marozeck, FR 2-7100, Chicago, Ill.;* CENTRAL, *Donald Dobbins, GL 4-9638, Canton, Ohio.;* EAST COAST, *John J. McManus, MA 7-3996, Manhassett, N. Y.;* NEW ENGLAND, *Warren G. McDonald, FR 4-0663, Schenectady, N. Y.;* SOUTHWEST, *Kenneth R. Lundy, DA 7-5716, Dallas, Texas;* SOUTHWEST, *William H. Ramsey, UN 4-6369, Houston, Texas.*

Coors
ALUMINA CERAMICS
COORS PORCELAIN COMPANY
600 Ninth Street • Golden, Colorado
Print Ins. 27 on Reader Service Card

PLYMPRENE
NEOPRENE SPLICING COMPOUND
¾" Wide
30' Roll
AFFORDS MAXIMUM RESISTANCE TO OIL AND WEATHERING
CAT NO. 2091
TRADE PR CO MARK
MADE IN U.S.A.
PLYMOUTH RUBBER CO., INC., CANTON, MASS.

the ASTM requirement by 20%, while it exceeds the elongation requirement by 40%. A 30-mil tape, dielectric strength claimed is 450 vpm. Fusion and tackiness are excellent, it is stated, and high and low temperature extremes have no effect. Plymouth Rubber Co. Inc., 59 Revere St., Canton, Mass.

Print No. Ins. 105 on Reader Service Card

Improved Insulating Compound For Military Applications

An improved insulating compound covers the complete range of military specifications Mil W 5086A and Mil W 16878C, types B, C, and D. Designed primarily as an insulation in applications requiring a temperature range of 105°C to –55°C, improved #2100 reportedly combines excellent high temperature properties with superior low temperature characteristics required for thin and heavy wall insulations used in missile, cable, aircraft, and other government specifications. The Blane Corp., Canton, Mass.

Print No. Ins. 106 on Reader Service Card

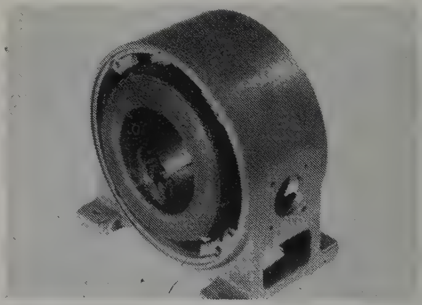
Copper-Clad Epoxy/Paper Laminate For Printed Circuits

A new grade of copper-clad epoxy/paper-base laminated plastic for printed circuit manufacturing, "Phenolite" grade EP-492-1, reportedly offers better electrical properties than XXXP grades and improvements over standard epoxy/paper laminates in flexural strength, cold shearing, and flame resistance. The following average values have been reported for 1/16″ thick specimens of the base material based on ASTM and other test methods: flexural strength lengthwise of 25,000 psi, crosswise 23,000 psi; impact strength lengthwise of .59 ft lb/in, crosswise .58 ft lb/in; water absorption rate of .44% in 24 hrs; dissipation factor (1 mc) of .031; dielectric constant (1 mc) of 4.17; insulation resistance of 190,000 megohms; arc resistance of 120 seconds; extinguishing time after 30 sec exposure of 1-3 sec; and maximum operating temperature of 250°F. With copper foil cladding, the material has a peel strength of 9-10 lb/in for 1 oz cladding and 12-14 lb/in for 2 oz cladding; dip solder resistance at 500°F is 15-20 sec; and surface resistance (etched Retma comb pattern, 95 hr/35°C, 90% RH) is 2,300,000 megohms. National Vulcanized Fibre Co., 1061 Beech St., Wilmington 99, Del.

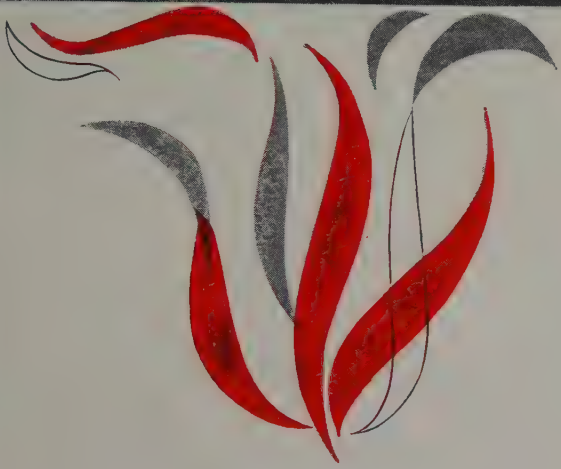
Print No. Ins. 107 on Reader Service Card

Room-Cure Epoxy with Low Exotherm

A new room temperature curing, semi-flexible, transparent epoxy impregnating and encapsulating resin is stated to have a low exothermic heat rise during cure. Called "Scotchcast" brand electrical resin No. 8, its semi-flexible qualities (Shore D hardness, 70) make it unusually resistant to mechanical and thermal shock stresses for a room temperature curing resin. Cast about a metal insert designed to reproduce expansion and contraction stresses encountered in actual service, the resin withstands cycling from 130°C to —55°C for 10 cycles, as called for in Mil I-16923C tests. Flexibility also is said to enable the resin, designed for class B (130°C) operation, to retain its properties after severe heat aging. Electric strength of 400 vpm and excellent adhesion to most metals and plastics are claimed.



For the first time phenolic XXXPC laminates with...



both FLAME RETARDANCE and COLD PUNCHABILITY

New Resinox 495 Varnish makes it possible for the first time to produce phenolic laminates with both flame retardance and excellent cold punching characteristics. Paper-based laminates impregnated with Resinox 495 meet the electrical, physical, and mechanical requirements of NEMA standards for XXXP and XXXPC copper-clad laminates—yet they cost far less than other laminates with equivalent properties.

Laminates made with Resinox 495 are especially recommended for printed circuits used for commercial radio and TV applications, and as copper-clad laminates for electronic computers and military applications, or for any other application where flame retardant laminates are desirable or mandatory. Use coupon below for additional data, and list of leading laminators now supplying laminates made with Resinox 495.

RESINOX: REG. U. S. PAT. OFF.

Monsanto

MONSANTO INITIATOR IN **PLASTICS**

Print Ins. 28 on Reader Service Card

MONSANTO CHEMICAL COMPANY, Plastics Division
Room 808, Springfield 2, Mass.

Please send me technical data bulletin on Resinox 495, also list of laminators supplying laminates made with it.

NAME____________________TITLE____________________

COMPANY____

ADDRESS____

CITY____________________ZONE________STATE________

Nemcoite
Molding
Plates

MILLED INDIA MICA MOLDING PLATES

	Plate	Bond	Insulation Class
No. 1	Shellac Molding Plate	Shellac	B
No. 61	Epoxy Molding Plate	Epoxy	F
No. 51	Silicone Molding Plate	Silicone	H

They are designed expressly for molded insulation, such as commutator end rings, slot cells and troughs, coil forms, spools, tubes and bushings.

COMMUTATOR MICA END RINGS

Nemcoite mica end rings range in size from those required for fractional horsepower motors up to traction motors. They are made to meet the requirements of Insulation Classes B, F, or H, as specified.

NEW...
A comprehensive brochure on various types of mica insulation has just been prepared. A copy of this helpful reference will be sent on request.

NEW ENGLAND
Mica CO.
INCORPORATED
Waltham 54, Massachusetts

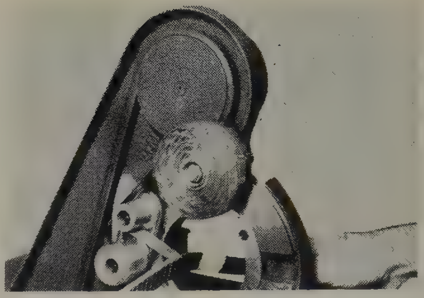
Print Ins. 29 on Reader Service Card

Applications include encapsulation of motor stators, coils, and transformers; potting of connectors; and coating of printed circuit boards. With a mixing ratio of 1 to 1 by weight, the 100% solids, two-part resin also provides handling ease. Specific gravity of the mixed resin is 1.11, initial viscosity at room temperature is 5,700 cps, pot life is 1 to 2 hrs and cure cycles range from overnight at room temperature to 2 hrs at 140°F. Dept. W1-315, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.
Print No. Ins. 108 on Reader Service Card

Polyethylene for Cellular, Thin Wall, Low Dielectric Constant Cable Insulation

A new polyethylene compound specifically designed for thin-walled cellular primary insulation, "Bakelite" DGDA-2580, is said to be tougher than previously available plastics for cellular extrusion. At 30% cellular composition, the new polyethylene also is stated to have higher tensile strength than solid polyethylene insulation, while maintaining the same excellent low-temperature flexibility. A uniform dispersion of spherical gas cells within the extruded materials makes possible a relatively low dielectric constant, thus permitting telephone singles insulation with reduced wall thicknesses. Since this will also allow a reduction in size and weight of the overall cable, less outer jacketing is required and more cable can be wound on a reel. The properties of the new cellular polyethylene also recommend it as insulation for high-frequency applications such as video pairs, community coaxial cable, and antenna lead-in, and as bedding for insulated members to fill out multi-conductor cables. Dielectric constant reported is in the range of 1.5 to 1.7, or slightly more than half that of solid materials. Excellent moisture resistance is also claimed. Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.
Print No. Ins. 109 on Reader Service Card

Fusible Silicone Rubber for Electrical Insulating Tapes



A new and improved fusible silicone rubber compound is specifically designed for fabricating electrical insulating tapes. The new material, designated K-1628, reportedly offers both manufacturers and users of insulating tapes distinct advantages over existing compounds. Its high modulus — 110 psi at 100% elongation—permits application by machine wrapping. The high modulus prevents over-stretching, thereby insuring greater uniformity during coil wrapping and providing better insulation. Fabricators benefit because K-1628 is pre-conditioned for almost immediate use and thus requires only minimum plasticizing. It is easy to handle and high green (uncured) strength permits increases in extrusion rates and manufacturing output by as much as 100% over other available fusible compounds. Tape made of K-1628 has a smooth glossy surface and high tack, binding readily to itself, although not tacky to the touch. It releases readily from a "Mylar" interleaf. Silicones Div., Union Carbide Corp., 270 Park Ave., New York 17.
Print No. Ins. 110 on Reader Service Card

Higher Flash Point Insulating Oil Protects Electrical Equipment

A higher minimum flash point has been announced for "Diala" oil AX, an electrical insulating oil for large transformers and high output electrical equipment. The improved product has minimum flash point specification of 295°F (Cleveland Open Cup Method), with typical flash point test values ranging from 300 to 305°F (149 to 151.5°C). The high flash oil is said to make it practicable for equipment manufacturers to designate power equipment for operation safely and continuously at substantially higher outputs and temperatures than heretofore. Higher flash reportedly has been achieved without change in the accepted maximum viscosity specification of 60 SSU @ 100°F, the optimum viscosity rating agreed on by electrical equipment manufacturers.

Standardize with this multi-purpose film wire success!

Phelps Dodge

POLY—Thermaleze®

Has replaced as many as six standard wires in these important applications!

Motors

Coils

Dry-type Transformers

Best balance of overall properties without sacrifice of any one property!

High dielectric for thermal protection at operating temperatures (Class F 155C)!

Cost reduction benefits through standardizing inventory to one wire for most applications!

Any time your problem is magnet wire, consult Phelps Dodge for the quickest, surest answer!

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CORPORATION
INCA MANUFACTURING DIVISION
FORT WAYNE, INDIANA

PD MINE TO MARKET

Poly-Thermaleze®—Patent applied for.

Print Ins. 30 on Reader Service Card

Patapar®

INSULATING PARCHMENT

will make a money-saving coil

(or we'll eat the Patapar!)

Try Patapar on your automatic coil winding machinery. If you don't end up with a better coil—*and a saving on wire and production time*—we'll eat the Patapar! We dare to make this offer for two reasons:

1. It has been proved—time and time again—that Patapar Insulating Parchment will save money.

2. In the unlikely event that we'd have to eat the Patapar—we could—because it's that pure.

Patapar has a fibre-free toothed surface which grips wires more firmly than other materials without wearing through. It is more rigid, it machines better. And Patapar has a high minimum point of voltage breakdown.

PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
NEW YORK, N.Y. CHICAGO, ILL. SUNNYVALE, CALIF.

Send for pure-enough-to-eat samples of Patapar Insulating Parchment.

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Diala oil AX is said to be oxidation inhibited, and to resist oxidation, sludging, and lacquer formation at the higher operating temperatures. Shell Oil Co., 50 West 50th St., New York 20.

Print No. Ins. 111 on Reader Service Card

Electronic Coating, Encapsulant, And Adhesive for 1000°F

A new rigid high temperature adhesive, "Raiseal" No. 350, reportedly offers high electrical resistance and low thermal conductivity and is suitable for use up to 1000°F (538°C). It is expected to find important uses as a structural adhesive and also for coating and encapsulation of electronic components. Radiation Applications Inc., 36-40 37th St., Long Island City 1, N. Y.

Print No. Ins. 112 on Reader Service Card

'Orlon'-Fiber Reinforced Phenolic Molding Compound

New Orlon-fiber reinforced phenolic molding compound reportedly molds well in thin sections at low pressure. Material (RX 745) offers a combination of mechanical stability, good electrical insulating properties, chemical resistance, and toughness. It is recommended for terminal boards, connectors, and other applications where shock, fatigue, and wear-resistance are involved. Electrical properties cited include arc resistance of 131 seconds, dielectric constant of 4.15 @ 1 mc immersed in 23°C water for 24 hrs, and dielectric strength (step by step) of 318 vpm immersed in 50°C water for 48 hrs. Some key physical characteristics reported are: tensile strength of 7,000 psi, flexural strength of 10,000 psi, impact strength of 0.6 Izod (ft lbs/in notch), a compressive strength of 32,000 psi, and a heat distortion temperature of 270°F (all values average). Material is supplied in nodular form especially suited for automatic preforming and molding equipment. Rogers Corp., Rogers, Conn.

Print No. Ins. 113 on Reader Service Card

Coaxial Ceramic Seals for Traveling Wave Tubes

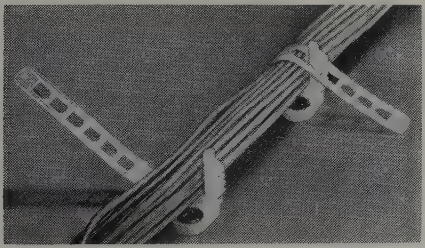
New coaxial ceramic seals for traveling wave tubes are approximately 1″ long and 3/8″ diameter. They consist

of a dense alumina insulator sealed to a monel inner conductor and surrounded by a nickel outer conductor. Metalization of the coaxial seals is achieved by a new method of metal deposition control which reportedly results in RF match characteristics superior to those obtainable by other methods. The seals are mass produced on ceramic fixtures in a contamination-free plant. Ceramics International Corp., 39 Siding Place, Mahwah, N. J.

Print No. Ins. 114 on Reader Service Card

Nylon Clamps for Both Temporary And Permanent Cable Assembly

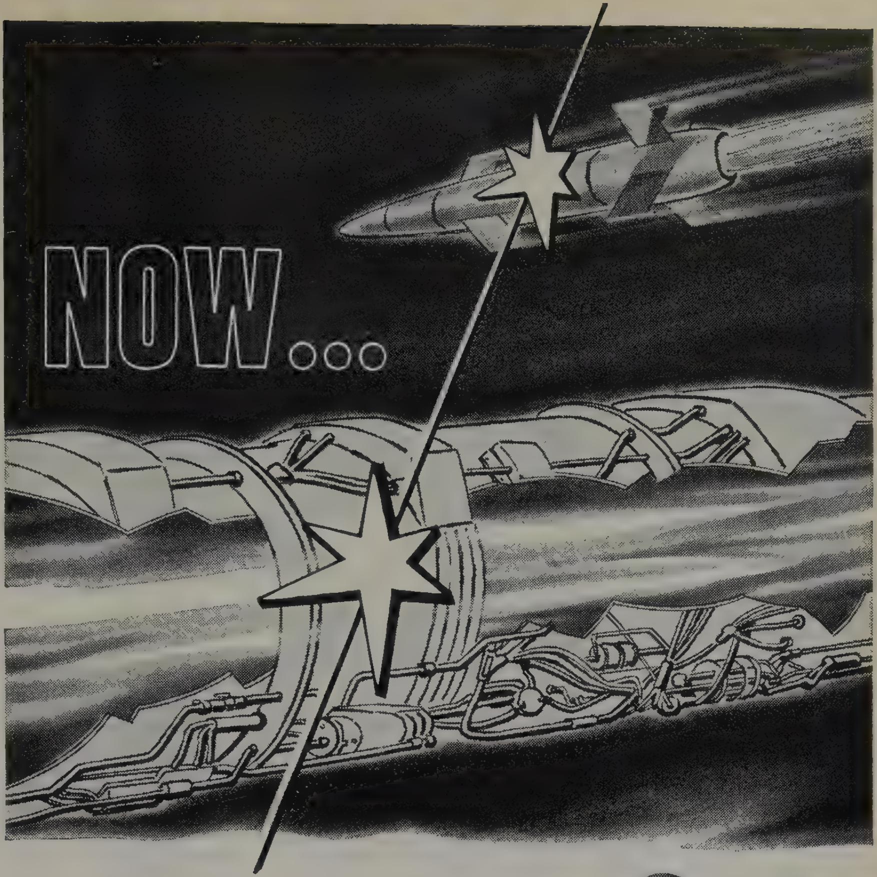
New nylon clamps for both temporary and permanent assembly of cables are said to require no tools for fast, easy clamping and hanging of bundles or single cables. "Tab-Loc" clamps are adjustable from 3/8″ to 3/4″ diameter bundles. Easily opened for adjustment, removal, or addition of wires, they are also re-usable. Clamps reportedly have passed rigid testing without a single failure, including vibration tests up to 20G at 2000 cps and 50 impact shock tests from 5G through 120G. They are made of solid nylon to provide dielectric strength and corrosion resistance. Weckesser Co. Inc., Dept. IN-2, 5701 Northwest Highway, Chicago 46.



Print No. Ins. 115 on Reader Service Card

Vinyl Resin for Adhesives

A new vinyl copolymer emulsion is stated to possess an unusually high degree of inherent tack and adhesion to specific surfaces. Designated Resin D-845, the new emulsion provides clear, soft, non-re-emulsifiable films and is compatible with borax and various organic solvents. The material is



a silicone resin sleeving
so flexible you can get it in spools or coils!

- **FLEXIBLE** — may be manipulated at all temperatures, —70° to +500° F. without cracking or checking. Dielectric strength remains even when sleeving is knotted.
- **HIGH DIELECTRIC STRENGTH** — up to 7000 Volts, depending on grade. Certified to meet government specification MIL-I-3190, latest revision.
- **RADIATION RESISTANT** — retains nonconductive properties under greater-than-average random intensities.
- **WIDE RANGE OF SIZES** — .010″ I.D. to 3″ I.D. Larger sizes possible.
- **COLOR CODED** — available in 12 brilliant, non-fading colors.
- **CHOICE OF LENGTHS** — for the first time, continuous lengths up to 5000 feet available, thus eliminating waste. 36 inch lengths where preferred.
- **DEPENDABLE, FAST DELIVERY** — Immediate delivery on standard items from stock . . . 48 hours for new production.

VARGLAS
SILICONE RESIN
"500"
SLEEVING

Extremely useful where miniaturization increases heat and dielectric load on smaller wires, Varglas Silicone Resin "500" is only one of many sleevings made by Varflex for this type of service. If you have a special insulating problem, call on our engineers for modifications of existing products, or for developmental work to meet stringent new requirements.

- *Send for free test samples.*

Varflex SALES CO., INC.
"Never Satisfied Until You Are"

Manufacturers of Electrical Insulating Tubing and Sleeving • 320 N. Jay St., Rome, N.Y.
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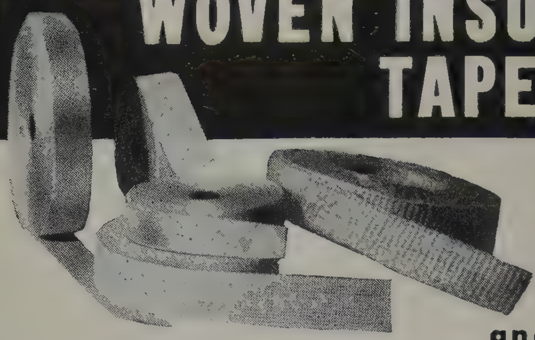
ATLAS is your best source for
WOVEN INSULATION TAPES



- GLASS
- ASBESTOS
- SYNTHETICS

and combinations

ATLAS Glass-Asbestos TAPES for economy and performance

1. Superior Abrasion Resistance
2. Good Resin-Absorption
3. Strength Without Extra Bulk
4. Resistance to Moisture, Corrosion, Alkalis and Acids.

NEW ATLAS COMBO TAPE FOR SPECIAL ADVANTAGES

In COMBO TAPE, half the warp is glass fibre, the opposite half is Dacron®, and the crosswise filling is glass fibre. For half lapping, the underlying glass wrapper lowers cost and gives higher classification. The Dacron® overlayer stretches to accommodate the half lap and shrinks down tightly on the underlying glass tape when heat is applied in curing.
® Du Pont Registered Trademark

Write, wire or phone for information or literature.

Atlas Asbestos Company

Famous for quality electrical insulation since 1922
GLASPUN
441 Walnut Street • NORTH WALES, PA.
Telephone: OXbow 9-4851 Cable Address: "LASBEST"

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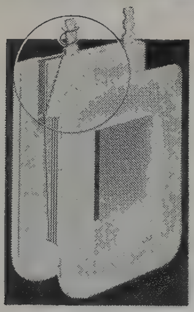
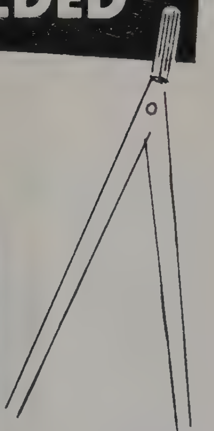
NYLON—Bobbins & Coil Forms

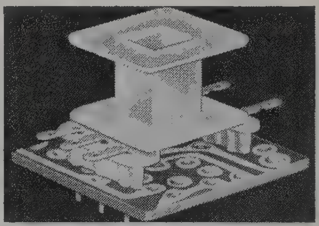
AMERICAN MOLDED

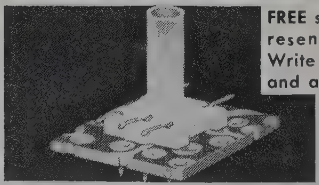




INSULATED LEAD SLOT
Automatically insulates lead and eliminates washers and taping. This revolutionary bobbin speeds up automatic winding.

PRINTED CIRCUIT TRANSFORMER BOBBIN
Complete with lugs, for printed circuit transformers. Eliminates cost and assembly of terminal board! The lugs are embedded in nylon for permanent locations especially designed to prevent wire breakage.





ONE PIECE COIL FORM
Complete with lugs, for printed circuit I. F. and oscillator coils. Integral construction, the tube and base cannot come apart—constant core torque . . . designed to prevent wire breakage.

FREE samples and catalogs. Representatives in major cities. Write to this office for names and addresses.

NO TOOL COST ON STOCK BOBBINS—SPECIAL BOBBINS TO YOUR SPECIFICATIONS

American Molded Products Company
2721 WEST CHICAGO AVENUE • CHICAGO 22, ILLINOIS

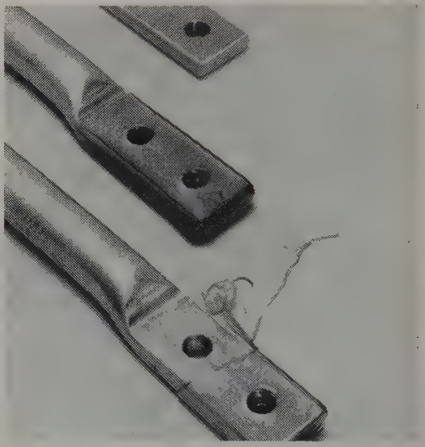
Print Ins. 34 on Reader Service Card

suggested for use in adhesives formulations, particularly those for pressure-sensitive and contact adhesives. The permanent dry tack and outstanding adhesion of the material make it suitable for bonding difficult surfaces such as polyethylene and polypropylene. It is also suggested for use as an agent to modify heat seal temperature, tack and flexibility of standard polyvinyl acetate emulsions. Shawinigan Resins Corp., Dept. SW, Springfield, Mass.

Print No. Ins. 116 on Reader Service Card

Peelable Cellulose Protects Terminals

Peelable protection for any electrical conductor compression terminal is provided in the form of a cellulose dip coating on the pad surface. As easily removed as a banana peel, the protective coating guards the carefully ground pad surfaces against the rigors of shipping, storage, and handling. Protected by the new coating, the ground pad is said to provide a near-perfect electrical contact for bolted connections. The protective medium eliminates possible contact between terminal pads and dirt or oxidizing conditions that would normally make necessary "repeat installations." Rome Cable Div., Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.



Print No. Ins. 117 on Reader Service Card

Epoxy Resin for Filament Winding

Developed to help meet handling problems encountered in the filament winding process, "Bakelite" epoxy ERL-0500 resin reportedly has a low viscosity, is easy to handle, and properly cured exhibits excellent mechanical properties. It is trifunctional, has a built-in tertiary amine catalyst, and a viscosity of 2000-4000 cps at room temperature. High cure temperatures are said to have no detrimental effect on ERL-0500 filament wound structural properties but do increase the heat distortion point considerably. Girth stresses approaching 120,000 psi and interlaminate shear values of 4000 psi have been developed. In filament wound structures required for elevated temperature applications as in missiles and rockets, an ERL-0500-based system is stated to be particularly effective. The low viscosity and prolonged pot life of ERL-0500-based systems reportedly permit the winding of complicated glass patterns with no practical limit on winding time or on the complexity of the pattern laid down, and ensure good wet-out of filaments and uniform resin flow. Union Carbide Plastics Co., Division of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 118 on Reader Service Card

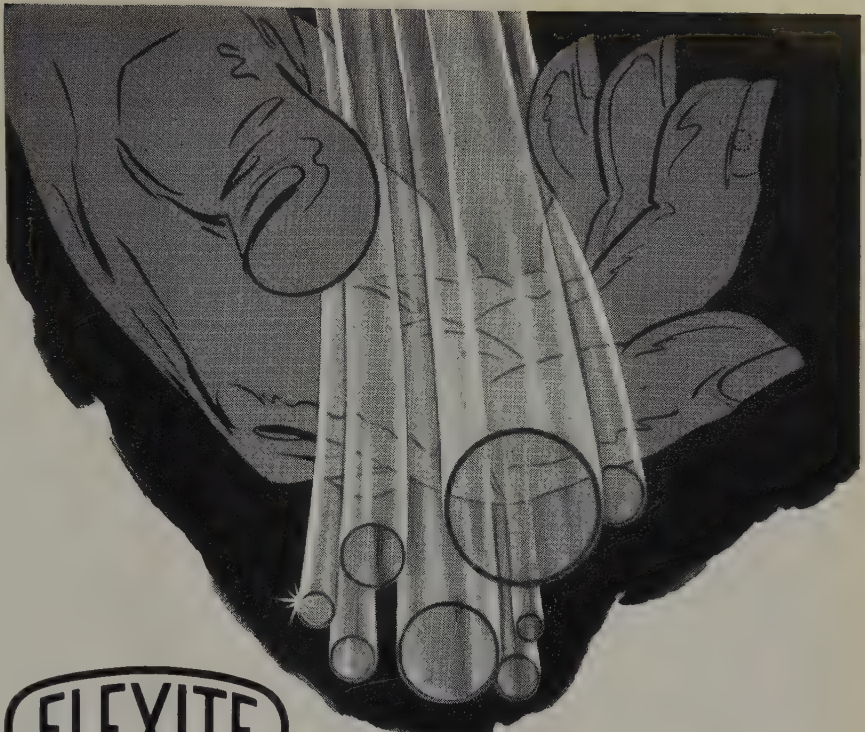
Electrical Components Cleaner

New type of cleaner, "Margar" electrical components grade silver-gold cleaner, is specially formulated for use in the electronics and electrical industries. It is a specialized product for the removal of tarnish or oxide discoloration on silver, gold, and their alloys. The cleaner reportedly facilitates soldering, reduces contact resistance, improves appearance, is safe for all silver and gold, and can be used over and over. Margar Manufacturing Labs. Inc., 159 Marjorie Drive, Buffalo 23, N. Y.

Print No. Ins. 119 on Reader Service Card

Electrical Cleaning Spray in Can With Flexible Extension Tube

"Swish Elektrokleen," an aerosol


FLEXITE®

HT105c

extruded vinyl tubing

*H*ere . . . try it! This is MARKEL HIGH TEMPERATURE TUBING, extruded of non-migratory polymeric-plasticized resins—a product from the *Line of Excellence*—Markel-made to meet these tough specifications for insulating (or mechanical and chemical) tubing:

● non-flammable; U/L-approved for applications up to 105°C ● dielectric strength, more than 700 v/mil ● tensile strength, 2700 psi ● low temperature flexibility, to —30°C ● oil resistance, flexible indefinitely when immersed ● crystal-clear in all sizes, #24 to 1½" ● colors, up to 10 standard in many sizes.

Try it; you'll stay with it. What do you need—Markel sample file? —prices? —test lengths? Call, write, or wire; you'll get action.

L. FRANK **MARKEL** & SONS
SINCE 1922

1 SOURCE *for* EXCELLENCE *in*
Insulating Tubings, Sleevings, and Lead Wire

NORRISTOWN, PENNSYLVANIA

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SOLVE WIRE-STRIPPING PROBLEMS
with NEW Wassco® GLO-MELT WIRE STRIPPER

FAST, FLEXIBLE AND ECONOMICAL REMOVAL OF ALL PLASTIC INSULATED WIRE

Wire stripping problems fade away with a Wassco Glo-Melt wire stripper. This new tool is a cool, light, highly flexible hand piece with a single, heavy duty Nichrome cutting element for long life. It can be used for on the job applications or for bench work with optional foot control. The Wassco Glo-Melt wire stripper gives you a cleaner, faster job . . . is perfect for hard-to-get-at places . . . strips insulation including Teflon, Nylon and fiberglass up to No. 8 insulated wire with a simple *twist of the wrist.* No sharpening or adjusting,—just plug in and you are ready instantly to do a perfect stripping job with speed and ease. Inquire about our 10 day free trial.

206-B

Wassco GLO-MELT DIVISION
AMERICAN ELECTRICAL HEATER COMPANY
DETROIT 2, MICHIGAN
American Beauty ELECTRIC IRONS SINCE 1894

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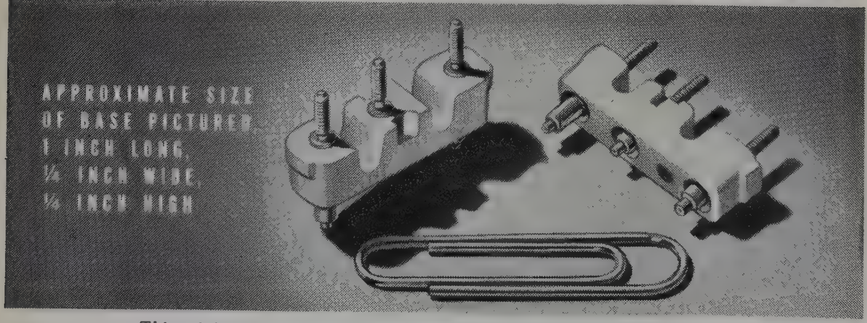
Here's How Haveg Solved the Problem...
with HAVELEX®
PRECISION MOLDED RIGID INORGANIC INSULATING MATERIAL



This miniature switch base molded with Havelex, contains four different stainless steel inserts with precious metal plating. Three inserts (which include #0-80 male threads) go all the way through the mold and provide precision mountings on both sides for assembly. The #0-80 female threaded insert is designed to protrude from one face and is approached by a molded counterbore from the other. Mold is designed to accommodate alternate terminal inserts when unthreaded models are required.

Haveg engineers recommended Havelex for this particular molding because of its combination of properties. Completely inorganic, with metal inserts integrally molded in place. Precision tolerances with faithful reproduction from part to part. Heat resistance for continuous operation in excess of 700°F.

Haveg engineers will be happy to work with you on your particular project—to help you "Keep ahead with Haveg." *Remember*—Havelex offers all of these unique features: **Dimensional Stability • 1000°F. Continuous Temperature Resistance • Dielectric Strength • Mechanical Strength • Low Loss, Low Power Factor • Arc Resistance • No Moisture Absorption • Integrally Molded Metal Inserts • Hermetically Sealed Inserts.**

Keep Ahead with HAVEG. FIRST IN Engineered PLASTICS

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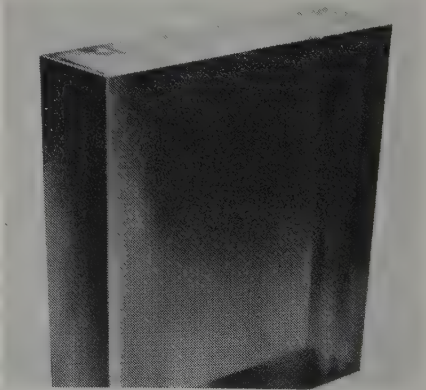
Print Ins. 37 on Reader Service Card

compound for cleaning electrical equipment, electronic components, power tools, and other parts, is available with a removable extension tube for cleaning hard-to-reach places and to provide a "pinpoint" spray for cleaning miniaturized components. The polypropylene tube is said to be sufficiently flexible to permit spraying around corners and into small areas. Used without the extension tube, the can provides a long range, drenching spray for more thorough cleaning. The extension tube is offered at no increase in cost (a case of twelve 16-oz cans sells for $15.60. Trial orders of one can, $1.30). Montgomery Chemical Co., Jenkintown, Pa.

Print No. Ins. 120 on Reader Service Card

Polycarbonate Rod and Slab in Large Sizes

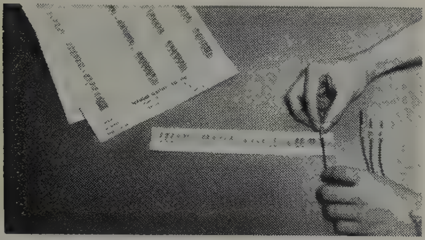
It is now possible to obtain polycarbonate rod and slab in a complete range of sizes up to 72″ x 12″ x 3″. "Zelux" polycarbonate rod and slab, which has been normalized by a patented Liquo-Temp annealing process, is said to be readily cut, drilled, tapped, milled, or otherwise machined to close dimensionally stable tolerances by conventional machining methods. The material is a transparent, light amber thermoplastic reportedly exhibiting extremely high resistance to heat distortion and extraordinary impact resistance. In addition, excellent dimensional stability and good electrical properties are claimed. Westlake Plastics Co., Division L,



Lenni Mills, Pa.
Print No. Ins. 121 on Reader Service Card

Insulation Sleeving Markers Packaged To Organize Wiring

Assembly productivity in wiring electrical and electromechanical equipment is said to be increased with a new insulation sleeving called "Idensulation," which improves production efficiency by providing work organization for wiring procedures. Idensulation is insulated tubing with designation or identification codes which have been thermo-branded for high clarity. The marked tubing is cut to length and secured to perforated assembly work cards with adhesive-backed tapes. The coded tubing is arranged in numerical, alphabetical, or sub-assembly order, in accordance with a user's connection list or wire-routing operation sheet, ready for assembly breakdown and assignment to work bench position. It is produced in a wide range of standard insulating materials, including the "shrink-on" types, and in a variety of colors. Materials conform to military and industrial specification. Samples available. Manger Electric Inc., North State St., Stamford, Conn.
Print No. Ins. 122 on Reader Service Card



Plastic Electrical Tape

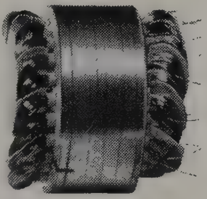
Plastic electrical tape comes in a packaged roll of ½" x 150' and carries the Underwriters' Laboratory seal of approval. The new PreS-Stix product reportedly resists oil, water, and weather. The American PreS-Stix Tape Co., 4058 Beaufat at Gratiot, Detroit 7.
Print No. Ins. 123 on Reader Service Card

Safe Soldering Flux Remover For Electronic Circuits

A new safety solvent for the removal of soldering fluxes from electronic circuits, known as "Vythene-PC," reportedly dissolves fluxes and salts much more effectively than conventional chlorinated solvents. It is

NOW FROM 3M RESEARCH TWO NEW INSULATIONS

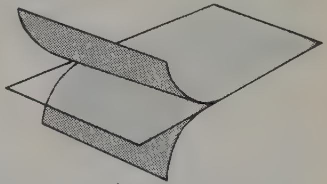
NEW COATED GLASS INSULATION SURVIVES CLASS F PUNISHMENT



"Irvington" Brand Epoxy Coated Glass No. 2525 is an exceptional insulation for electrical equipment that operates continuously at high temperatures. Retains its electric strength and flexibility even after sustained aging at class F temperatures and is particularly suited for use in epoxy impregnated or cast units.

Extremely flexible and snug conforming, No. 2525 offers excellent compatibility with epoxy systems and will not contaminate or degrade transformer oils. In tape, sheet or roll form in thicknesses of .003", .007" or .010".

NEW LAMINATED WEB/FILM/WEB INSULATION IS ADHESIVE FREE



"Irvington" Brand Polyester Laminate No. 2541, a unique 100% polyester web/film/web construction, is formed without an adhesive. Eliminates the major cause of delamination and allows better resin penetration.

No. 2541 provides constant dielectric strength under high humidity conditions and prevents moisture entrapment during encapsulation or dipping. Non-woven web is free of adhesives or contaminants and completely compatible with varnishes or encapsulating resins for maximum absorptivity. Tough three layer construction withstands rough handling in cuffing or forming operations. Available in .007", .010" and .015" thicknesses to meet all electrical and mechanical needs. For further information on these insulations write: 3M Company, 900 Bush Ave., St. Paul 6, Minn. Dept. ECA-81.

"IRVINGTON" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.

Irvington Division
MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW
3M COMPANY

Print Ins. 38 on Reader Service Card

said to be lower in cost than fluorinated hydrocarbons and more economical in evaporation rate. Vythene-PC has no flash point, is low in toxicity, and high in purity. It can be reclaimed with suitable distillation equipment, or users can take advantage of a reclamation service offered by the manufacturer. Data and samples available. Tect Inc., Northvale, N. J.

Print No. Ins. 124 on Reader Service Card

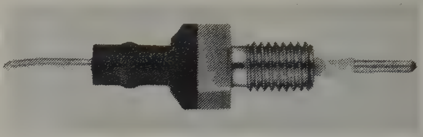
One-Part Epoxy Resin for Dip Coating Electronic Components

"Eccocoat" D30 is an epoxy resin dip coating compound which is said to provide a strongly adhesive surface coat with excellent moisture resistance on transformers, capacitors, and similar components. It is applied by conventional dip coating procedures and will not run or drip during the oven cure cycle. The amount of pick-up can be controlled by the preheat temperature and the immersion time. Manufacturer states cure is accomplished with no evolution of volatile materials, and thus the cured surface coat is impervious and provides excellent protection against moisture and weather. A controlled amount of flexibility in the cured resin reportedly imparts outstanding resistance to thermal and mechanical shock. Emerson & Cuming Inc., Canton, Mass.

Print No. Ins. 125 on Reader Service Card

'Teflon'-Insulated Connector for Use in Rugged Environments

A new type of connector is designed for high temperature 20,000 psi service. Contact is made by fitting a pin into a hole of closely controlled diameter. The tempered beryllium copper pin is bent and acts as its own spring when plugged into the hole. This eliminates the need of leaf springs or other complicated contacts, which often fail when rubber extrudes into contact voids at high pressures. Fluid seal is accomplished by means of a molded "O" ring seating into the mating connector. Fluid pressure compresses the external neoprene sleeve to form the seal. The connection is stated to be made by "feel" as the parts are joined. In addition, 10 identifying dots are molded on the side of each part. Mating circuits can be discerned even in the dark by feeling the number of dots. Standard models feature Teflon internal construction with silver plated pins, and are rated for 20,000 psi, 400°F service. Dielectric strength is 3000 v. Current rating is 10 amps. A complete range of types and sizes are available to meet most applications from bulkhead feed-through to cable connectors. Keystone Engineer-



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Bi-Seal Tapes
Coil Winding Machines
Cotton Tapes and Webbings
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Extruded Plastic Tubings
Fiberglas Tapes, Cords and Sleevings
Friction and Rubber Tapes
Insulating Varnishes and Compounds
Low-Pressure Laminates
Magnet Wire
Mica—Built-up and Raw
Motor Enamels
Pressure Sensitive Tapes
Safe-T-Seal
Silicone Rubber Extruded Tubings
Silicone Rubber Coated Fiberglas Tubing
Silicone Wedges
Teflon Tapes and Tubings
Undercutting Machines and Saws
Varnished Sleevings and Tubings—Cotton, Fiberglas and Rayon
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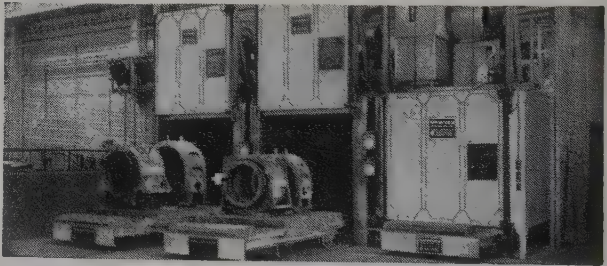
STANDARD OR SPECIALLY DESIGNED

YOUNG BROTHERS OVENS

for dependable, economical BAKING and DRYING in the ELECTRICAL INDUSTRY



Car-Bottom Type Stator Baking Ovens

The specialized knowledge gained in over 60 years of experience and in thousands of installations are available to meet your particular needs in Varnish Baking — Wire Enameling — Rubber and Plastic Curing, Paint and Enamel Baking — Glass Annealing — Service Shop Ovens. Young Brothers Batch or Conveyor Ovens will improve your product . . reduce your costs. Write for New Bulletin 157.

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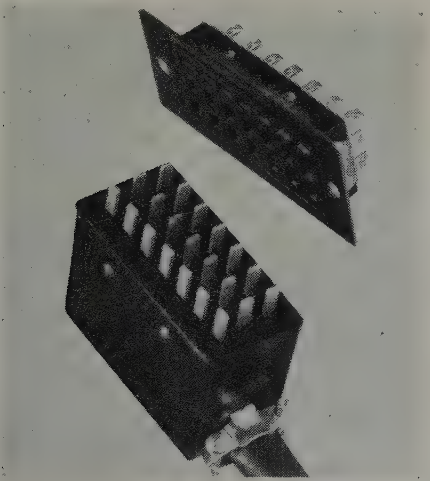
ing Co., P. O. Box 14366, Houston 21, Texas.

Print No. Ins. 126 on Reader Service Card

Electrical Connectors

New 3300 series "Beauplugs" electrical connectors are rated at 750 v rms at a current capacity of 10 amps. Presently manufactured in 15, 18, 21, 24, 27, 30, and 33 contact configurations, the Beauplugs are used in telephone switchgear, automatic vending machines, communications equipment, electrical and electronic instruments, etc. Knife contacts in plugs are cadmium or silver plated brass, and in the socket double spring design phosphor bronze. Bodies are compression molded "Bakelite" and the backplates, which hold the contacts in place, are XXXP laminated phenolic to NEMA standards. Connectors are interchangeable with C-J 300 series. A new feature is the linear polyethylene backshell (or cap), for protection against moisture and dust, and which is said to have excellent appearance, dielectric strength, and shelf life. Beauchaine and Sons Inc., Lakeport, N.H.



Print No. Ins. 127 on Reader Service Card

Low-Cost Silicone-Glass Spacer Rods for Transformers

A new production process used in the manufacture of silicone-glass spacer rods for transformers is said to reduce the cost of the finished product by approximately 1/3. Pittsburgh Electrical Insulation Co., Inc., Lebanon School Rd., Pittsburgh 36, Pa.

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Phase Stable Coaxial Cable

New techniques reportedly produce

THESE ARE SPRAGUE'S TWO OUTSTANDING

HIGH-TEMPERATURE MAGNET WIRES

Tetroc®

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO 200°C

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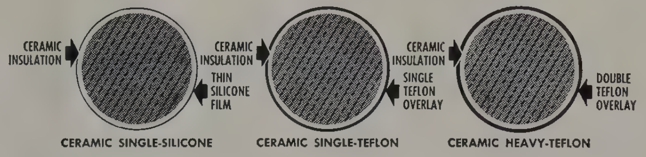
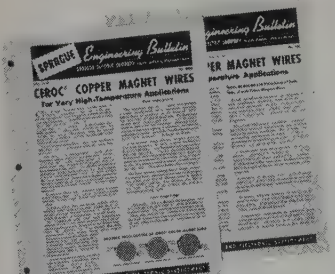
FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO 250°C



ENLARGED CROSS-SECTIONS OF CEROC® COPPER MAGNET WIRE

Sprague offers you a choice of 2 *truly* high temperature magnet wires: For continuous operation at hottest spot temperatures up to 200°C (392°F) and up to 250°C (482°F) for short periods of time—depend upon TETROC—an all Teflon-insulated wire available in both single and heavy coatings.

CEROC is Sprague's recommendation for continuous operation at hottest spot temperatures up to 250°C (482°F) and up to 300°C (572°F) for short periods of time. Ceroc has a flexible ceramic base insulation with either single silicone or single or heavy Teflon overlays. The ceramic base stops "cut-through" sometimes found in windings of all-fluorocarbon wire. Both Tetroc and Ceroc magnet wires provide extremely high space factors. ★ ★ ★ ★ ★


SPRAGUE Engineering Bulletin
CEROC® COPPER MAGNET WIRES
For Very High-Temperature Applications
Engineering Bulletin
MAGNET WIRES

FOR COMPLETE DATA WRITE FOR ENGINEERING BULLETIN 405 (TETROC WIRES) 400A (CEROC WIRES).

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TURBOTUF®
vinyl-
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A fibrous glass braid with a highly flexible, heat resistant vinyl coating . . . will not lose physical or electrical properties even when bent or knotted.

Turbotuf, a class B material is flexible, tough, chemical and moisture resistant, won't support combustion, has excellent thermal properties and dielectric strength, won't fray when cut. (Available in sizes #24 to 1″ I.D. in all standard colors.)

For more information and samples, and, if you wish, technical assistance in selecting the right insulation for your application, write or call

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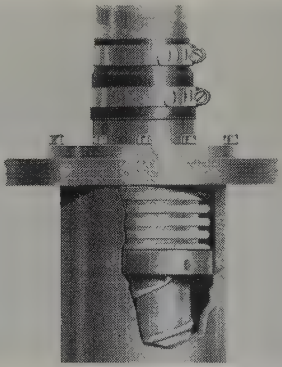
coaxial cable with a phase shift of only 20 parts per million/°C, within the range of 10° to 32°C. Normally, coaxial cable exhibits a 200 parts per million/°C phase shift over this temperature range. The process is said to be suitable for any coaxial cable design utilizing polyethylene dielectric, and to permit full conformity to the environmental and electrical requirements of MIL-C-17C specifications. Major applications at present include radar and sonar, where sending and receiving signals must be compared with minimum variable introduced by the coaxial cable. Times Wire & Cable Co. Inc., Division of The International Silver Co., Wallingford, Conn.

Print No. Ins. 129 on Reader Service Card

End Closure for Pipe-Type Cables

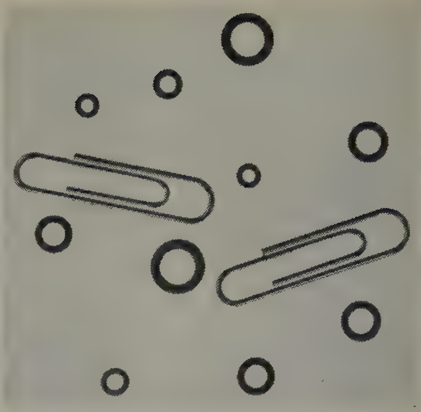
New end seal for pipe-type cables allows for the expansion and contraction of the cable. The device reportedly does not require excessive pressure against the cable which might damage cable insulation. At the same time, the oil seal is not disrupted by cable movements. The end closure, or "flexible barrier," has application to semi-stop joints and potheads on high pressure, oil-filled, pipe-type systems. Cable Accessories Div., Anaconda Wire and Cable Co., Hastings-on-Hudson, N.Y.



Print No. Ins. 130 on Reader Service Card

Silicone O-Rings Are Flashless And Dimensionally Stable

Special O-rings tradenamed "Silic O Rings" are said to be virtually flashless—flash is held to a maximum of .001″ on all units. However, outstanding feature reported is dimensional stability. They are offered in a range of very small sizes not normally available from conventional sources. While the O-rings are molded in various compounds, the company specializes in silicone rubber O-rings because of silicone's excellent high and low temperature characteristics; its resistance to chemicals, ozone, and aging; and its resistance to compression set. A. P. M. Corp., 41 Honeck St., Englewood, N.J.



Print No. Ins. 131 on Reader Service Card

Printed Wiring Boards For Military Circuits

Military requirements on electronic equipment circuits reportedly may be met without high cost and design delay by using circuit boards which incorporate circuits from the Navy Handbook of Preferred Circuits in a modular printed wiring design. The "Preferred" circuit boards are completely etched, requiring only drilling and inserting components for finished assembly. Sample Preferred circuit board with complete listing of stock circuits, $2. Advanced Designs Inc., 914 Lullaby Lane South, Vienna, Va.

Print No. Ins. 132 on Reader Service Card

Color Coded Connector Cables

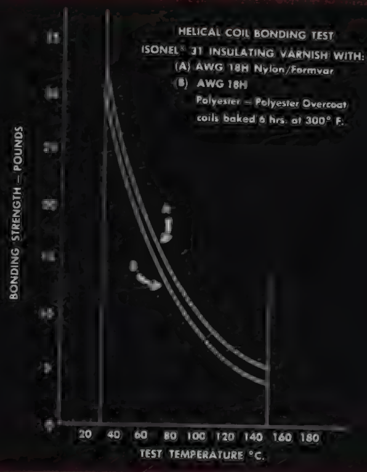
Connector cables for tape, magnetic phono, ceramic phono, tuner, amplifier, microphone, speaker, etc., are coded in five colors for quick, easy lead identification. One basic color is recommended for each connection from jack to cord to jack. Channel or multiple connections may be marked by means of available colored marking strips applied to handles or color dots applied to chassis. Cords are colored flexible plastic covered shielded cables; handles are injection molded plastic with added length for easy grasping and smaller diameter for hard-to-reach places. Connectors are available in a wide range of styles. Chart showing "Recommended Color Code" for 11 basic connections avail-

CLASS F ISONEL 31 VARNISH

for complete compatibility with the new POLYESTER-TYPE MAGNET WIRES

Check these features

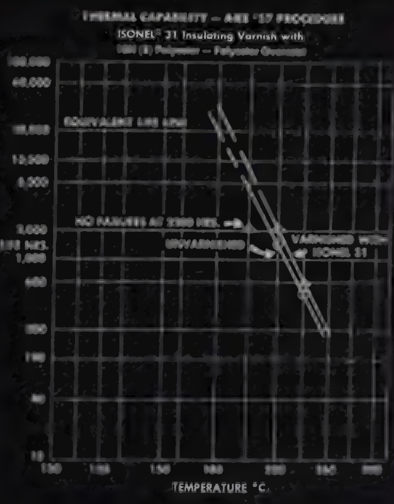
- Excellent Heat Life
- High Bond Strength
- Good Electric Strength
- Complete Dip Tank Stability
- Moisture, Chemical and Oil Resistance
- Contains No Injurious Solvents
- Provides Smooth, Uniform Build
- For Class A, B, or F Applications



Peak performance sustained by using the new multi-purpose, polyester type magnet wires with Schenectady's ISONEL® 31 Varnish.

Extensive tests in our Electrical Testing and Development Laboratory have demonstrated this versatile varnish is completely compatible with the new polyester-type wire enamels.

Test results shown in graphs very pointedly illustrate the high bonding strength when applied to polyester magnet wire.



ISONEL 31 contains no catalyst, cures by polymerization and does not carbonize at Class F operating temperature.

Complete details about ISONEL 31 Varnish are available in a new technical bulletin. Write for your copy now.

Insulating Varnishes and Wire Enamels — Since 1906

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able. Zoron Inc., 612 W. Monroe St., Chicago 6.

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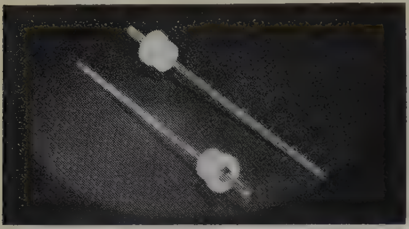
Feed-through Pigtail Extension Eliminates Soldering

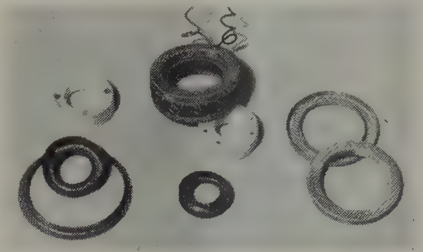
A soldering operation is eliminated through the use of the Press-Fit type FT-M-9 miniature feed-through terminal with pigtail lead. The unit has a standard pin lug on the opposite end from the pigtail lead. The pigtail lead is 1½″ long, but may be specified in other lengths. The lead allows bending to other terminations for point-to-point wiring. It is said to be especially adaptable to printed wiring boards and popular in computer assemblies. Sealectro Corp., 610 Fayette Ave., Mamoroneck, N.Y.



Print No. Ins. 134 on Reader Service Card

Stator End Caps of Open Weave Glass Fabrics

Stator end caps for insulating coil end turns on the stators of small motors are now available in open weave glass fabrics. These porous stator end caps hold coil ends in a fixed position and permit resin flow through the insulator during encapsulation to provide a solid, void-free unit. Glass fabrics are formed with phenolic, melamine, or silicone resin to fit all temperature classes. Stevens Products Inc., 86-88 Main St., East Orange, N.J.



Print No. Ins. 135 on Reader Service Card

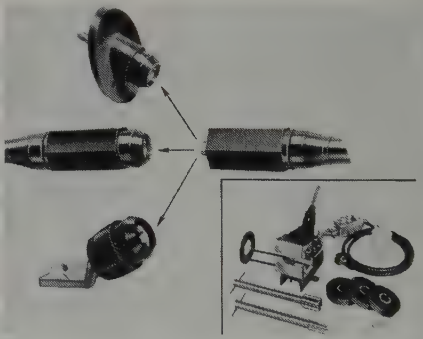
Line Post Insulators For Large Conductors

New "Locke" line post insulators feature extra-wide wire grooves to accommodate large conductors. Available in five ASA sizes from 23 kv through 69 kv, the new insulators have a 1¾″ wire groove, with circular depths ranging from ⅝″ in the lowest rating to ¾″ in all other ratings. The insulators reportedly have a rated cantilever strength of 2,800 lbs and an impact strength substantially higher than other similar units. Units tested at twice their cantilever rating produced no breakage in the porcelain. The new insulators also feature a metal disc which makes the insulator seal air tight, prevents moisture from entering the porcelain column, and eliminates the conventional rubber diaphragms. Long or short line post studs for steel or wood cross-arm mounting are available in each rating. General Electric Co., Insulator Dept., Box 57, Baltimore 3, Md.

Print No. Ins. 136 on Reader Service Card

Cable Accessories in Extended Size Range

New cable connectors, panel and machine receptacles, and cable lugs to fit flexible power cable ranging in all sizes up to 750 MCM extra flexible are all available either in waterproof, neoprene insulated styles, or in hard fibre insulated types for use where moisture is not a hazard. The high pressure, low resistance connection may be quickly locked or disconnected by rotating a quarter of a turn. Where waterproof, neoprene insulation is desired, a low cost vulcanizing kit permits the user to make his own waterproof cable connections or repairs in the plant on his own cables in minutes. Kit includes thermostatically controlled 110 v vulcanizing press, uncured neoprene vulcanizing tape, etc. Cam-Loc Div., Empire Products Inc., 9213 Blue Ash Rd., Cincinnati 42, Ohio.



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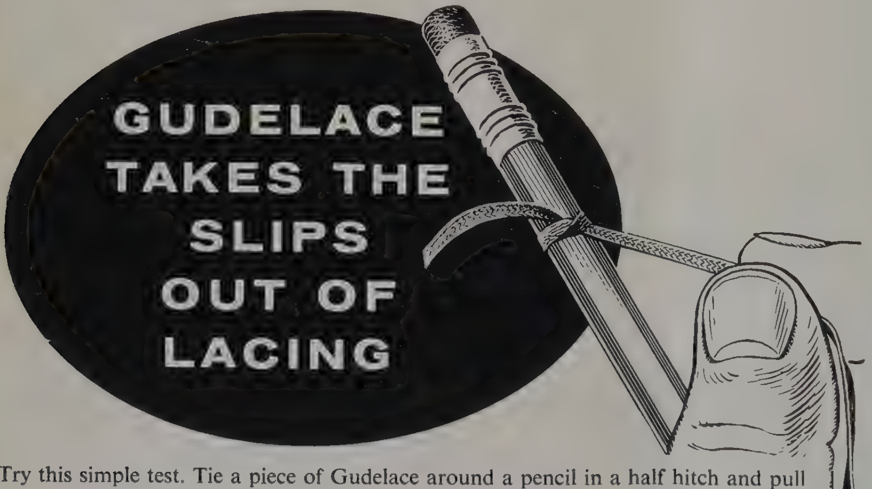
GUDELACE TAKES THE SLIPS OUT OF LACING

Try this simple test. Tie a piece of Gudelace around a pencil in a half hitch and pull one end. Gudelace's flat, nonskid surface grips the pencil—no need for an extra finger to hold Gudelace in place while the knot is tied!

Gudelace makes lacing easier and faster, with no cut insulation, or fingers—no slips or rejects—and that's *real* economy. Gudelace is the original flat lacing tape. It's engineered to *stay* flat, distributing stress evenly over a wide area. The unique nonskid surface eliminates the too-tight pull that causes strangulation and cold flow. Gudelace is made of sturdy nylon mesh, combined with special microcrystalline wax, for outstanding strength, toughness, and stability.

Write for a free sample and test it yourself. See how Gudelace takes the slips—and the problems—out of lacing.

GUDEBROD BROS. SILK CO., INC.

Electronic Division
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New York 1, N.Y.

Executive Offices
12 South 12th Street
Philadelphia 7, Pa.

VISIT GUDEBROD BOOTH 4718 at the WESCON SHOW

Print Ins. 44 on Reader Service Card

Better Refrigerant-22 resistance with new Formvar/based enamel

A new FORMVAR based magnet wire enamel has been developed specifically for hermetic as well as general purpose service. The new insulation offers excellent resistance to Refrigerant-22 . . . extractibles ½% or below. Also, it offers high cut-thru resistance . . . up to 300°C. Plus the same service-proven balance of properties of standard FORMVAR-with-phenolic enamels.

Consider this unequalled combination of key properties:

- Refrigerant-22 extractible content below ½%; excellent blister resistance before and after prebake.
- Excellent moisture resistance as determined by the boiling water test.
- Wet dielectric strength greater than 2000 volts per mil after 24 hour submersion in distilled water.
- Electrical resistance retained at elevated temperatures.
- Thermal life of 60,000 to 100,000 hours at 130°C when overcoated with suitable varnishes.

This new enamel has been well proved in the field. The enamel or coated wire is available from your regular supplier under the FORMETIC or other trademark. Consult him for more details on how this new insulation will pay you real dividends in trouble-free performance.

SALES OFFICES: ATLANTA, CHICAGO, LOS ANGELES, NEW YORK, SPRINGFIELD, CLEVELAND, SAN FRANCISCO, GREENSBORO, ST. LOUIS.

IN ENGLAND & EUROPE: SHAWINIGAN LTD., MARLOW HOUSE LLOYD'S AVENUE, LONDON, E. C. 3

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polyvinyl formal by
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RESINS

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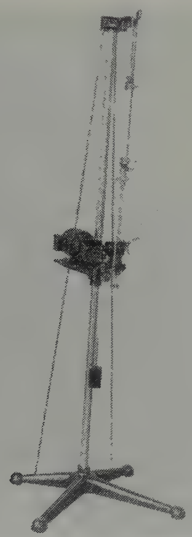
New Instruments and Equipment

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card—no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Elongation Tester for Conductor Wire

A special tester designated model XE-5 is designed specifically for measuring elongation of copper wire, primarily to determine the suitability of copper conductor wire for stranding. It can also be used to quickly obtain an accurate and economical evaluation of any similar material where elongation is the prime consideration. Model XE-5 is equipped with wedge wire clamps which permit rapid inserting and removal of test specimens. Elongation is indicated by an easy-to-read 5 ft steel tape. Clamp separation is at the rate of 12″/minute. The tester may be arranged either for wall mounting or furnished with a floor stand. Scott Testers Inc., 211 Blackstone St., Providence, R.I.



Print No. Ins. 201 on Reader Service Card

High Voltage Sphere Gaps For Testing Insulation

Complete line of high-voltage sphere gaps are for use by electrical, cable, and insulation manufacturers; industrial plant maintenance departments; utility central stations; and laboratories to measure a-c, d-c, and impulse voltage in dielectric materials and all kinds of insulated apparatus. They are also suitable for use as a protective device to prevent excessively high voltage from being applied to the test specimen, to calibrate testing equipment, and to check wave form of applied test voltages. Diameters of 2.54, 6.25, 12.5, 25, 50, 75, and 100 cm and spark-over ratings of 8.5 to 1338 volts are available. They can be obtained in bench or floor-mounted units ranging in price from $400 to $20,000. Each assembly features a pair of polished, adjustable metal spheres mounted on an insulated framework. The gaps can be precisely adjusted and are equipped with a separate current-limiting, non-inductive resistor assembly to limit current during spark-over. High Voltage Specialty Transformer Section, General Electric Co., Holyoke, Mass.

Print No. Ins. 202 on Reader Service Card

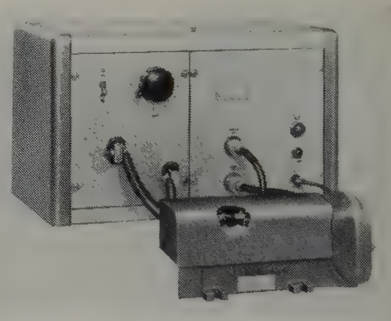
Walk-In Ovens Rated 850°F

New walk-in production ovens, called "Super Duty S-Type" ovens, are rated at 850°F (max), and are available in six models from 250,000 to 1,500,000 btu/hr. Heaters are available in gas, oil, or electricity. All oven bodies and heaters are constructed of 18 gauge steel exterior, 16 gauge aluminized steel interior, and have 6″ of insulation. Each oven is equipped with two swing doors, gravity exhaust stack, approved safety system, and indicating-type controls. Interior dimensions of the ovens range from 4′6″ x 6′ x 6′ to 8′ x 12′ x 6′9″. Fast, uniform heating is said to be featured. Bulletins 202-3 and P-202-3A available. Despatch Oven Co., 619 SE Eighth St., Minneapolis 14, Minn.

Print No. Ins. 203 on Reader Service Card

Stripping and Cutting Machine For Shielded Cable

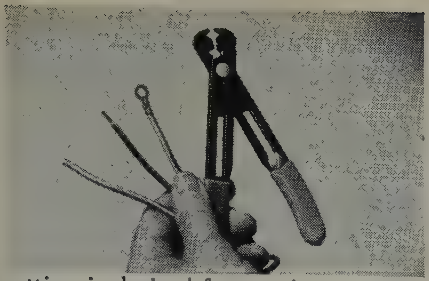
An air-operated machine designed for the semiautomatic stripping of braided shielding wire cuts and fuses together the ends of the shielding, preventing unraveling and matting of the cut wires. This simplifies subsequent handling of the stripped cable and speeds the attaching of terminals or connectors. Production rates of 600 to 1200/hr reportedly can be achieved on most cables. Wires with soft or temperature-sensitive insulation materials can be stripped without any damage to the insulation, it is stated, and both copper and stainless steel braid can be handled. The machine consists of a control cabinet with the necessary power supply and timers and a separate air-operated stripping head. The stripping length is adjustable from ½″ to 1½″, or longer, if specified. Only one wire size can be stripped with a given size of dies, but tools for different sizes of cable can be mounted in a few minutes. The machine is also adaptable to the cutting and fusing of fine stranded conductors and other exposed stranded or braided wire. Price is $1000 to $1500. Ewald Instruments, Box 124, Kent, Conn.



Print No. Ins. 204 on Reader Service Card

Solderless Terminal Tool

Small hand tool made of spring steel cuts solid or stranded wire, strips off the insulation, and crimps on solderless terminals. Cutting edge is ground—not stamped. A sliding set screw can be used when a particular



setting is desired for continuous stripping of a particular size wire. The #9900 tool will fit into a shirt pocket, yet enough leverage can be obtained to crimp a #12-10 size wire. It is designed to work with wire sizes from #22 through #10. Price is $2.50. R. N. Hunter Sales Co., 9851 Alburtus Ave., Sante Fe Springs, Calif.

Print No. Ins. 205 on Reader Service Card

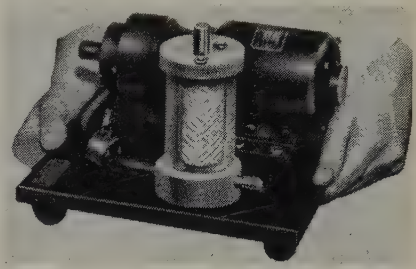
All-Transistor D-C Voltmeter

High impedance DC TRVM's are completely self-contained instruments that require only 3½″ of panel space and weigh less than 1½ lbs. New circuit techniques reportedly eliminate zero drift and the necessity for zero controls. The amplifier section uses five transistors, and is chopper-stabilized, enabling a selection of ranges from as low as 100 mv on each side of zero, while maintaining a constant input impedance of 1 megohm (min). Performance is in compliance with appropriate MIL specs. Standard range for the model 305-1 is .5-0.5 through 300-0-300-v, d-c, i. e., zero-center; and for model 305-2 the standard range is 0-1 through 0-300-v, d-c, i. e., zero-left. Accuracy claimed is 2% of full scale. Instruments are extremely simple to install and maintain. They can be calibrated in the field without being removed from their position on the panel. Trio Laboratories Inc., Plainview, L. I., N. Y.

Print No. Ins. 206 on Reader Service Card

Miniature Filter Systems

A complete "Miniature" filter system is designed for use with small volumes of corrosive and expensive solutions or solvents requiring constant circulation or freedom from solid particle contamination. Model LAI-1 combines a miniature "Full-View" lucite filter chamber with an epoxy centrifugal pump powered by a 1/40 hp continuous duty motor. All the components are mounted on an 8″ x 9″ linen phenolic panel. Since it comes complete with filter tube, vinyl hose, and electric cord, it can be plugged into any 2 or 3 wire 110-v, d-c outlet for immediate operation. Capacity is 180 g/h on open pumping and this model will keep a 10-gal tank vigorously agitated or filtered to sparkling clarity. Model LAI-3, which has a larger filter chamber, can be



Get
FULLY AUTOMATIC PRODUCTION OF FINISHED WIRE LEADS

. . . any operator can produce 3,000 or more leads per hour in any insulated wire to 10-ga.

END wire stripping bottlenecks! You can measure, cut off and strip insulated wire with this *fully automatic* ARTOS machine . . . over 6,000 leads per hour with some types of wire.

With unskilled labor, solid or stranded wire leads are produced in lengths from 2″ to 194″—and stripped up to 2″ at one or both ends.

ARTOS MODEL CS-6

(*Left*) AE-563 PREFEEDER

Completely automatic, self-adjusting unit with ⅓ hp. motor. Requires no attention after wire has been threaded into stripping machine. Heavy reels roll into cradle or can be mounted on a shaft.

ALSO AVAILABLE: Extra equipment to mark leads with any code. Other machines also attach prefabricated terminals in strip form to your wire leads.

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Pyles AIR-OPERATED SEALANT GUNS
reduce material waste up to 75%

Save TIME, MATERIAL and MAN HOURS with PYLES high efficiency equipment.

- Quality built for long service.
- Ideal for two-part compounds.
- Sturdy, all-metal construction.
- Disposable polyethylene liners save cleaning.
- Smooth, uniform flow. Dripless shut-off.
- Lightweight, easy handling.
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Write for detailed literature and prices.

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ordered for up to 25-gal tanks. Bulletin 602 available. Sethco Mfg. Co. Corp., 2284 Babylon Turnpike, Merrick, L. I., N. Y.

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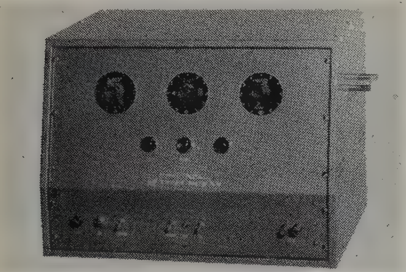
Automatic Capacitance Bridge

Model 8529 automatic capacitance bridge for high speed automated testing of capacitors may be set for a nominal accept value over a range of 0.001 microfarads, to 10.0 microfarads in increments of 0.001 microfarad. High, normal, and low indications are by means of three pilot lights. Connections may be provided for operation of automatic reject and classifying devices. Model 8529 may be supplied with high low limit controls adjustable within a range of ±0.25 to 25%. Associated Research Inc., 3777 W. Belmont Ave., Chicago.



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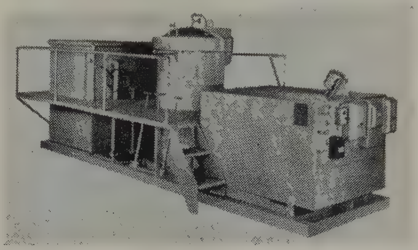
Impregnator for Transformers, Other Parts

Impregnating of transformers and other electrical and electronic parts may be accomplished through the use of the new "Mogullizer" which offers a number of advantages. A high vacuum (29″ or more) reportedly removes all air and moisture from castings to be sealed and assures positive penetration of the impregnating material into the most minute porosity; air pressure is applied for further impregnation. The Mogullizer is equipped with a thermostatically controlled electrically heated storage tank. It can also be supplied refrigerated or with both heating and refrigeration. It is shipped as a completely packaged unit with all gauges, piping, valves, and electrical controls mounted on a structural steel base, ready for hook up to utilities. Available in any size to meet individual production requirements. Metallizing Co. of America Inc., 3520 W. Carroll Ave., Chicago 24.



Print No. Ins. 209 on Reader Service Card

Plier Shaves and Cuts

The #A99 super fine midget diagonal cutter is designed specifically for shaving solder and cutting extended leads. The slim head allows working in the confined areas around circuit boards. Illustration shows the plier in use on an electronic filter. This plier comes with cushion grips and is available with or without spring. R. N. Hunter Sales Co., 9851 Alburtus Ave., Sante Fe Springs, Calif.

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PELMOR HAS THE ANSWER!

ENGINEERED COMPOUNDS:
Highly specialized electrical insulations. Resistant to extreme temperatures, fuels, oils, chemicals, weather and ozone. Designed to meet exacting physical specifications.

MATERIAL BASED ON:
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PELMOR TECHNICIANS, serving a broad range of industries, are ready to supply you with mixed compounds, molded parts or solution coatings.

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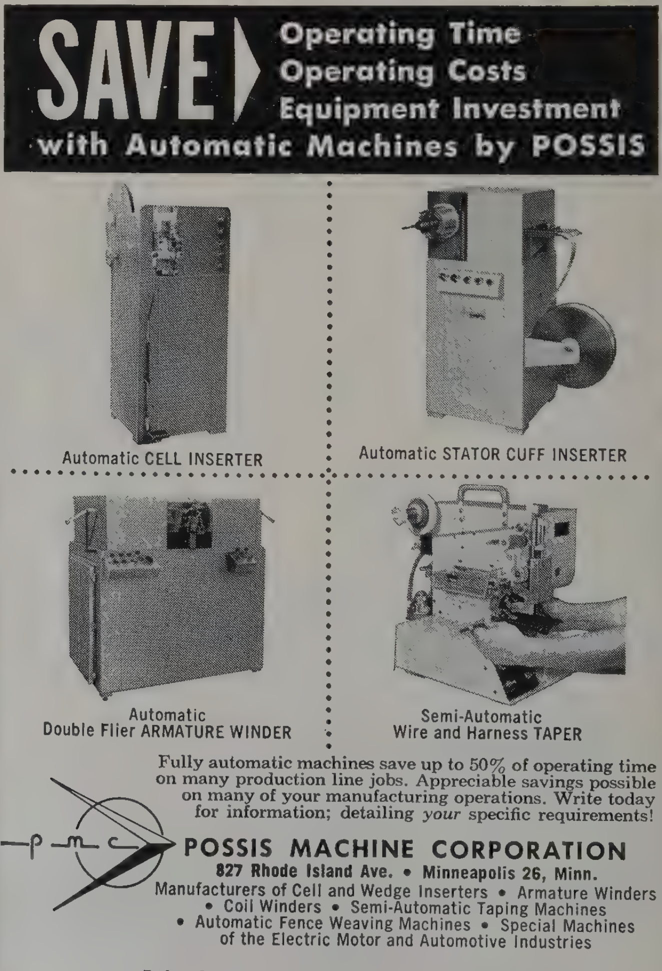

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New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation, *immediately forwards your requests to the companies concerned so that the literature can be sent to you promptly.*

Comprehensive Technical Report On Polycarbonate Films

Technical report CDC-396 details the physical and electrical properties of "Lexan" polycarbonate films. It compares extruded and solvent cast films and lists suggested applications. 13 pages. Chemical Materials Dept., General Electric Co., One Plastics Ave., Pittsfield, Mass.

Print No. Ins. 300 on Reader Service Card

Silicone and Fluorocarbon Product Data and Sample

New bulletin on molded, extruded, and bonded silicone and fluorocarbon products contains a sample of a silicone seal used in appliances. Electrical and other properties and advantages are covered. 4 pages. Moxness Products Inc., 1963 Indiana St., Racine, Wisc.

Print No. Ins. 301 on Reader Service Card

Thermoplastics Data Sheets

A series of informative plastic data sheets cover nine of the most widely used thermoplastic materials. Each file-size bulletin contains a brief description of the subject plastic and its typical uses, as well as specifications covering its physical, electrical, and chemical resistance characteristics. In addition, sizes, forms (sheets, profiles, tubing, etc.), and colors in which the material can be furnished are shown. Materials covered include elastomeric vinyl, rigid polyvinyl chloride, polyethylene (conventional and linear), polypropylene, styrene (standard, high impact, and light stabilized), butyrate, nylon, "Penton," and "Cycolac" ABS polymer. Conneaut Rubber and Plastics Co., Commerce St., Conneaut, Ohio.

Print No. Ins. 302 on Reader Service Card

Booklet on Silicones For Electrical Insulation

New publication, "Silicones for Electrical Insulation" designated CDS-288, contains more than 20 photographs and charts providing data and examples of silicones in use in a wide variety of electrical and electronic applications. Included are sections on silicone varnishes for impregnating and protective coatings, clear and opaque potting and encapsulating materials including rubbers, pressure sensitive adhesives, dielectric fluids, dielectric greases, wire and cable insulation, and combination constructions of silicones with other materials. Also shown are some testing facilities which are available for development of new products and applications and for the solution of complex customer problems. 8 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 303 on Reader Service Card

Booklet on 7 Copper-Clad Laminates for Printed Circuits

Seven grades or types of "Micarta" copper-clad laminates for printed circuits can be compared in physical and electrical properties in a new brochure (B8215). Recommended applications are included for each laminate to guide selection. Included in five paper-base phenolic grades are two new grades said to have exceptionally high fire resistance and one for applications that are electrically critical. Glass-base epoxy grades are included for applications that are critical in heat resistance and electrical properties, for precious-metal plating, and for applications such as computer cards. 8 pages. Westinghouse Electric Corp., Micarta Div., Hampton, S.C.

Print No. Ins. 304 on Reader Service Card

Bulletin on Properties and Uses Of Products for Dielectric Coatings

New product Reference File de-

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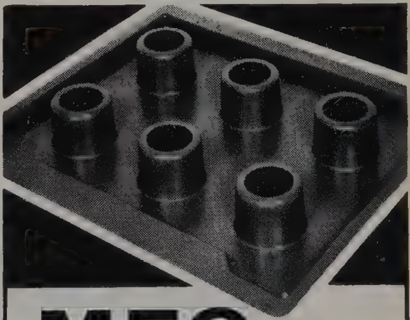

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combines these features:

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Add to these the excellent heat resistance, low moisture absorption and excellent moldability of MFG reinforced plastic—and you get better performance at significantly low cost!

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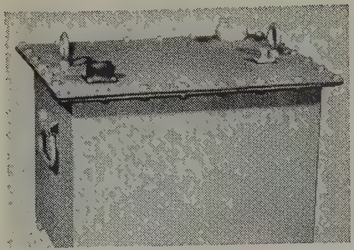

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scribes the physical properties and suggested uses of "Formvar" polyvinyl formal, "Butvar" polyvinyl butyral, "Gelvatol" polyvinyl alcohol, and "Gelva" polyvinyl acetate resins, emulsions, and spray-dried powders. 12 pages. Shawinigan Resins Corp., Dept. DP, Springfield 1, Mass.

Print No. Ins. 305 on Reader Service Card

Bulletin on Epoxy High Temperature Properties, Laminate Uses

Significant data on high-temperature properties of "Oxiron" epoxy resins and on the potential of these materials in laminate applications are reported in new technical bulletin No. 2. Information on uses in wet lay-up, prepreg, and printed circuitry laminate applications is given. Various curing systems that have been found to give the materials excellent high-temperature properties are also discussed. Formulation, cure cycle, and high-temperature properties of three systems are compared with those of a conventional epoxy system. Properties given cover such areas as heat distortion, flexural strength and modulus, stress relaxation, and dielectric loss factors. Supporting material includes eight tables and seven diagrams. 6 pages. Epoxy Dept., Food Machinery and Chemical Corp., 161 East 42nd St., New York City.

Print No. Ins. 306 on Reader Service Card

Asbestos-Phenolic Molding Compound And Insulations Featured in Catalog

A new asbestos molding compound in sheet form is featured in a catalog of parts and materials of use in fabrications for spacecraft and in missile applications. "Thermomat," specifically developed for parts subjected to extreme temperatures, is a non-woven asbestos felt saturated with a thermosetting phenolic resin, plus an inorganic filler. Catalog PK-162A includes complete tabular data on the available styles of Thermomat, including mechanical, thermal, and electrical properties of the molded part. Properties of the material before molding are also given. PK-162A also describes other products that are presently functioning in applications where flame erosion, temperature, pressure, or chemical action create critical conditions. Plastics discussed in the fabrication or composition of the standard and custom parts described include silicones, neoprene, and fluoroelastomers. "Teflon" and asbestos tape, tubing, and cloth are also covered. 28 pages. Johns-Manville, 22 East 40th St., New York 16.

Print No. Ins. 307 on Reader Service Card

Data Booklets on Polyester Resins For Potting and Reinforced Plastics

Data on polyester and acrylic-modified polyester resins are given in a group of booklets on the "Paraplex" P-series resins. The booklets discuss the physical and chemical properties of each of the grades of the resins and contain suggested formulations for various types of applications, including production of reinforced plastic parts and the potting of coils and other electrical components. Curing characteristics of the different products are given, along with specific properties of the cured resins. Rohm & Haas Co., Plastics Dept., Washington Square, Philadelphia 5, Pa.

Print No. Ins. 308 on Reader Service Card

Report on Polypropylene Solid And Cellular Coatings for Wire

Electrical and physical properties of "Tenite" polypropylene formulas developed for solid and cellular coatings of wire are described in Technical Report No. 7. The report details typical extrusion conditions for both types of coating, and presents comprehensive information (accompanied by diagrams) on techniques for applying the plastic material to wire and the equipment required. 8 pages. Plastics Div., Eastman Chemical Products Inc., Kingsport, Tenn.

Print No. Ins. 309 on Reader Service Card

Bulletin on PVC Products and Services

Comprehensive bulletin describes polyvinyl chloride homopolymers, copolymers, and compounds. Illustrated bulletin also describes the company's background, facilities, and the many uses of PVC in the electrical insulation, calendering, rigid sheeting, molding, and extrusion industries. 4 pages. Cary Chemicals Inc., P.O. Box 38, East Brunswick, N.J.

Print No. Ins. 310 on Reader Service Card

Brochure on Fire-Retardant Foams

Properties and potential applica-

tions of a rigid, fire-retardant polyurethane foam are described in a new brochure, D-300. It lists typical properties of general purpose, slab, high density, and high rise "Hetrofoam." Fire-retardance and other properties such as heat and dimensional stability, dielectric strength, dielectric constant, power factor, low water absorption, low moisture permeability, and low thermal conductivity are covered. 4 pages. Durez Plastics Div., Hooker Chemical Corp., North Tonawanda, N.Y.
Print No. Ins. 311 on Reader Service Card

Bulletins on Flame-Retardant Glass-Epoxy Laminates

"Fireban" 600, a flame-retardant glass-base/epoxy-resin laminated plastic, and Fireban 600 E, the copper-clad version, are described respectively in bulletins 51.5.20 and 51.5.21. Other characteristics listed for Fireban 600 include mechanical strength, interlaminar bond strength, electrical properties under high humidity conditions, chemical resistance, and moisture absorption. Bulletin 51.5.21 lists property values for copper-clad sheets and gives thickness tolerances for four different foil thicknesses (.0014", .0028", .0042", and .007"). Both standard tolerances and close tolerances are listed for composite sheet thicknesses. 2 pages each. Taylor Fibre Co., Norristown, Pa.
Print No. Ins. 312 on Reader Service Card

Bulletin on Curing Agent For Epoxy Resins

New bulletin C-103 describes characteristics of a mixture of aromatic polyamines which is said to be essentially 100% active as an epoxy resin curing agent. Bulletin covers desirable electrical and other properties imparted to cured castings and laminates, handling, mixing, pot life, toxicity, etc. 8 pages. Naugatuck Chemical, Div. of U.S. Rubber Co., Naugatuck, Conn.
Print No. Ins. 313 on Reader Service Card

Folder on Instrument for Accurate D-C Measurements

New folder shows how a wide range of precision d-c measurements can be made with a single instrument through selective expansion of the meter scale. 4 pages. Greibach Instruments Corp., 319 North Ave., New Rochelle, N.Y.
Print No. Ins. 314 on Reader Service Card

Booklet on Manufacturing of Insulated Thermocouple Wire

New catalog describes the processes used to produce "Tempak" mineral oxide insulated thermocouple materials. In addition to specifications and descriptive data on the metal-sheathed, ceramic-insulated wire, catalog Tempak/2550 also describes facilities and quality control system. 10 pages. Temptron Inc., 7030 Darby Ave., Reseda, Calif.
Print No. Ins. 315 on Reader Service Card

Catalog of Electronic Projects

Catalog lists a great many electronic projects which may be obtained for building by the customer. Circuits, parts lists, and explanatory notes are furnished in the projects. Instruments and components are for use in laboratory, production, home, and educational facilities. 16 pages. Henry Francis Parks Laboratory, P. O. Box 1665, Lake City Station, Seattle 55, Wash.
Print No. Ins. 316 on Reader Service Card

Technical Data Describes New Ceramic Diode Closure

Technical Bulletin M-103 describes a new ceramic diode closure, lists complete specifications and numerous advantages, and illustrates the closure both in cross-section as well as finished parts. Dimensions of the standard size closure in 6 stock sizes and end cap specifications are noted. 2 pages. Metalizing Industries Inc., 338 Hudson St., Hackensack, N. J.
Print No. Ins. 317 on Reader Service Card

Data Sheet on New Method of Determining Total Acidity

Data sheet outlines continuous, automatic method for determination of total acidity. The method details a means by which, with the addition of a suitable buffer, slight changes in acid concentration will give only slight changes in indicator color, instead of the usual sharp, complete change. A flow diagram is included, as well as actual chart recordings. 2 pages. Technicon Controls Inc., Research Park, Chauncey, N. Y.
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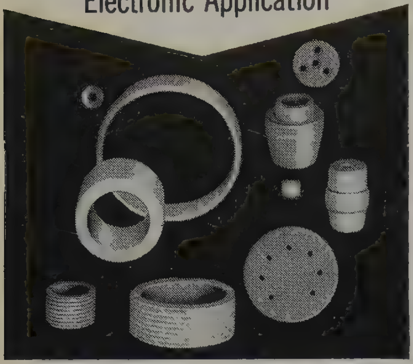
DIAMONITE
High Alumina Ceramics for Electronic Application



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Dates to Circle

Meeting and Convention Notices

Aug. 15-17 . . . Cryongenic Engineering Conference, sponsored by University of Michigan, Ann Arbor, Mich.

Aug. 16-18 . . . Second International Electronic Packaging Symposium, sponsored by University of Colorado, Boulder, Colo.

Aug. 22-25 . . . WESCON, The Cow Palace, San Francisco.

Aug. 23-25 . . . AIEE, Pacific General Meeting, Hotel Utah, Salt Lake City, Utah.

Aug. 28-Sept. 1 . . . ASME, International Heat Transfer Conference, University of Colorado campus, Boulder, Colo.

Sept. 6-8 . . . Joint Nuclear Instrumentation Symposium, AIEE-IRE-ISA, North Carolina State College, Raleigh, N.C.

Sept. 6-8 . . . IRE, National Symposium on Space Electronics and Telemetry, Albuquerque, N.M.

Sept. 12 . . . SPE, Plastics for Tooling, Retec sponsored by Central Indiana Section, Hotel Severin, Indianapolis, Ind.

Sept. 14-15 . . . Engineering Management Conference, AIEE and ASME, Hotel Roosevelt, New York City.

Sept. 21-22 . . . Industrial Electronics Conference, AIEE, IRE, and Instrument Society of America, Bradford Hotel, Boston, Mass.

Sept. 24-27 . . . AIEE-ASME, National Power Conference, St. Francis Hotel, San Francisco.

Sept. 24-29 . . . Illuminating Engineering Society, National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo.

Sept. 25-28 . . . American Welding Society, Fall Meeting, Adolphus Hotel, Dallas, Texas.

Oct. 1-5 . . . Electrochemical Society, Statler Hotel, Detroit, Mich.

Oct. 2-4 . . . IRE; Canadian Electronics Conference, Automotive Building, Exhibition Park, Toronto, Canada.

Oct. 5 . . . Plastic Foams, Retec sponsored by Buffalo Section, SPE, Niagara Falls, N.Y.

Oct. 9-11 . . . National Electronics Conference, sponsored by AIEE, IRE, Illinois Institute of Technology, Northwestern University, and the University of Illinois, Hotel Sherman, Chicago.

Oct. 10-12 . . . ASA, 12th National Conference on Standards, Rice Hotel, Houston, Texas.

Oct. 12-13 . . . SPI, 17th Annual New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N.H.

Oct. 15-20 . . . AIEE, Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich.

Oct. 23-25 . . . Conference on Electrical Insulation, National Academy of Sciences—National Research Council, Pocono Manor Inn, Pocono Manor, Pa.

Oct. 23-25 . . . IRE, East Coast Conference on Aerospace and Navigational Electronics, Lord Baltimore Hotel, Baltimore, Md.

Oct. 23-26 . . . The Wire Association, Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

Oct. 25 . . . SPE, Plastics in Major Household Appliances, sponsored by Kentuckian Section, Monogram Hall, Appliance Park, Louisville, Ky.

Oct. 26-28 . . . IRE, Electron Devices Meeting, Sheraton-Park Hotel, Washington, D.C.

Oct. 30-31 . . . IRE, Radio Fall Meeting, Hotel Syracuse, Syracuse, N.Y.

Nov. 6 . . . AIEE, Third Western Technical Conference, Biltmore Hotel, Los Angeles, Calif.

Nov. 7-9 . . . Eighth Industrial Electric Exposition, Electric League of Western Pennsylvania, Pittsburgh Room, Penn-Sheraton Hotel, Pittsburgh, Pa.

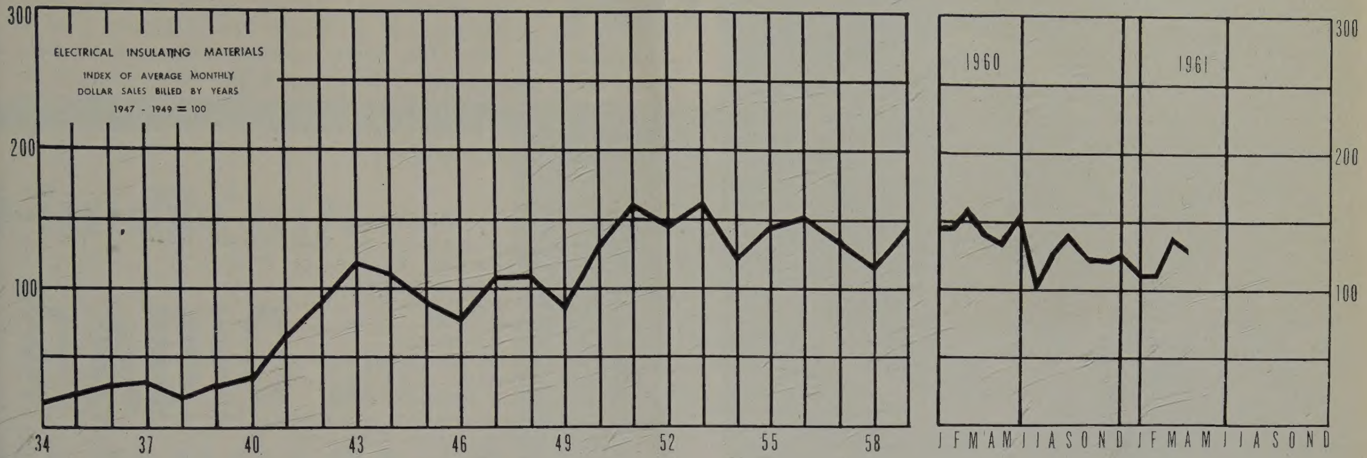
Nov. 16 . . . NEMA, Annual Meeting, Summit Hotel, New York City.

Dec. 12-14 . . . Eastern Joint Computer Conference, Sponsored by AIEE, IRE, and Association of Computer Manufacturers, Sheraton-Park Hotel, Washington, D.C.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing Materials	EASA	—Electrical Apparatus Service Assn.
ASME	—American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index



	Apr. '61	Mar. '61	Apr. '60
Index Series	125	142	140
Apr. '61 point change from other mos.		—17	—15
Apr. '61 % change from other months.		—12	—11

Index is based on 1947-1949 average month, inclusive=100

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- Vulcanized Fibre
- Coated Electrical Sleeving

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Class	Size Range	Typical Wall Thickness (AWG #22)
Lightweight Thin-wall Standard	AWG 28 - 0 AWG 30 - 0 AWG 24 - 0	0.006" 0.010" 0.012"

Available in eleven standard colors.

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Advertisers' Index

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Number	Advertiser	Page
Ins. 36	American Electrical Heater Co., Wassco Glo-Melt Div.	56
Ins. 42	American Enka Corp., Wm. Brand-Rex Div.	60
Ins. 34	American Molded Products Co	54
Ins. 17	Anaconda Wire & Cable Co	30
Ins. 46	Artos Engineering Co	65
Ins. 24	Associated Research, Inc	45
Ins. 33	Atlas Asbestos Co	51
Ins. 56	Belding Corticelli	71
Ins. 59	Bentley-Harris Manufacturing Co	Outside Back Cover
Ins. 15	Catalytic Combustion Corp., A Subsidiary of Universal Oil Products Co.	27
Ins. 7	Chemical Products Corp., Nelco Lacquer Div	11
Ins. 61	Chemplast, Inc	72
Ins. 11	Ciba Products Corp	17
Ins. 21	Coast Mfg. and Supply Co	41
Ins. 27	Coors Porcelain Co	48
Ins. 13	Crocker, Burbank Papers Inc	20
Ins. 54	Diamonite Products Mfg. Co	70
Ins. 16	E. I. du Pont de Nemours & Co. (Inc.), Film Dept	29
Ins. 22	Emmco Plastics Corp	42
Ins. 10	Essex Wire Corp., Magnet Wire Div	15
Ins. 58	General Electric Co., Laminated Products Dept	Inside Back Cover
Ins. 25	General Electric Co., Silicone Products Dept	46
Ins. 39	J. J. Glenn and Co	58
Ins. 55	Gries Reproducer Corp	70
Ins. 44	Gudebrod Bros. Silk Co., Inc., Electronic Div	62
Ins. 37	Haveg Industries, Inc., Taunton Div	56
Ins. 57	H. F. Hanscom & Co., Inc	71
Ins. 19	Industrial Instruments, Inc	38
Ins. 53	The Iten Fibre Co	69
Ins. 60	Johns-Manville, Dutch Brand Div	45
Ins. 3	The Macallen Co	2
Ins. 35	L. Frank Markel & Sons	55
Ins. 38	Minnesota Mining and Manufacturing Co., Irvington Div	57
Ins. 2	Minnesota Mining and Manufacturing Co., Mica Insulator Div	1
	Molded Fiber Glass Co	67
Ins. 28	Monsanto Chemical Co., Plastics Div	49
Ins. 6	Natvar Corp	9
Ins. 29	New England Mica Co., Inc	50
Ins. 8	New Jersey Wood Finishing Co	13
Ins. 9	Northern Plastics Corp	14
Ins. 14	The Okonite Co., Kennecott Wire & Cable Div	21
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Ins. 49	Possis Machine Corp.	66
Ins. 47	Pyles Industries, Inc	65
Ins. 26	Raybestos-Manhattan, Inc., Asbestos Textile Div	47
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Ins. 51	Sauereisen Cements Co.	68
Ins. 43	Schenectady Varnish Co., Inc.	61
Ins. 45	Shawinigan Resins Corp.	63
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Ins. 20	Union Carbide Corp., Union Carbide Plastics Co. Div.	39
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Ins. 52	Western Sky Industries	69
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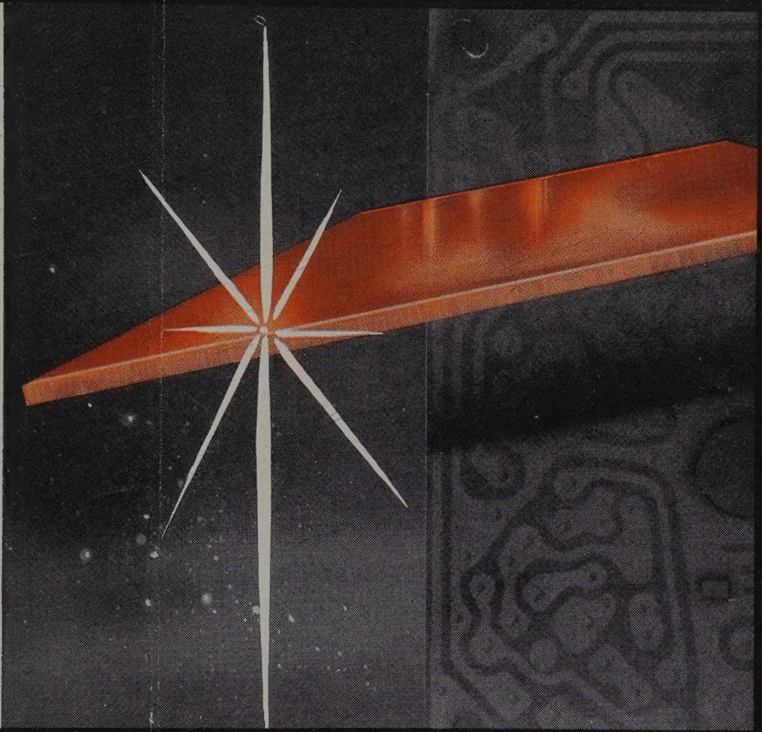

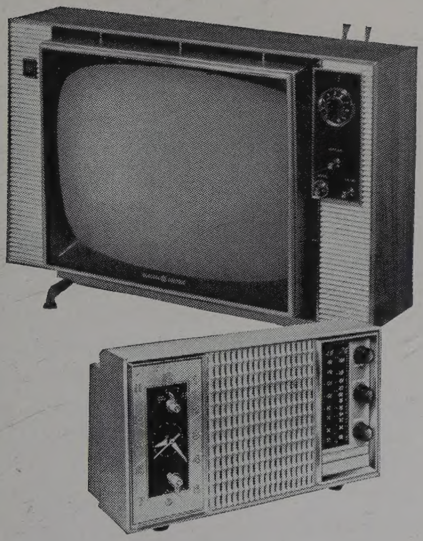

The General Electric TV Receiver Department is one of the major manufacturers of television sets sold in the United States. Contributing to this high volume has been the quality achieved through rigid manufacturing procedures. Part of the strict specifications call for Textolite 11571 XXX PC Copper-Clad laminate for use as circuit boards in all of their TV home receivers.

According to a TV Department spokesman, 11571 was selected because of its excellent insulation resistance under humid conditions. It has superior punching characteristics, stands up well in soldering and has good peel strength. Mr. W. W. Ward, Supervisor, Components, TV Receiver Department, said, "Since changing to 11571, production quality has been materially improved. It is the best laminate we've ever used."

Especially designed for use in television and radio receivers, G-E Textolite 11571 reliably meets UL testing standards, MIL-P 13949B and MIL-P 3115, type PBE-P specifications as well as NEMA XXX PC requirements. If you manufacture TV or radio equipment, you probably have an application in which 11571 would assure added reliability at a low cost. We will be happy to supply you complete information and samples. Write: Laminated Products Department, Section I-81, General Electric Co., Coshocton, Ohio.

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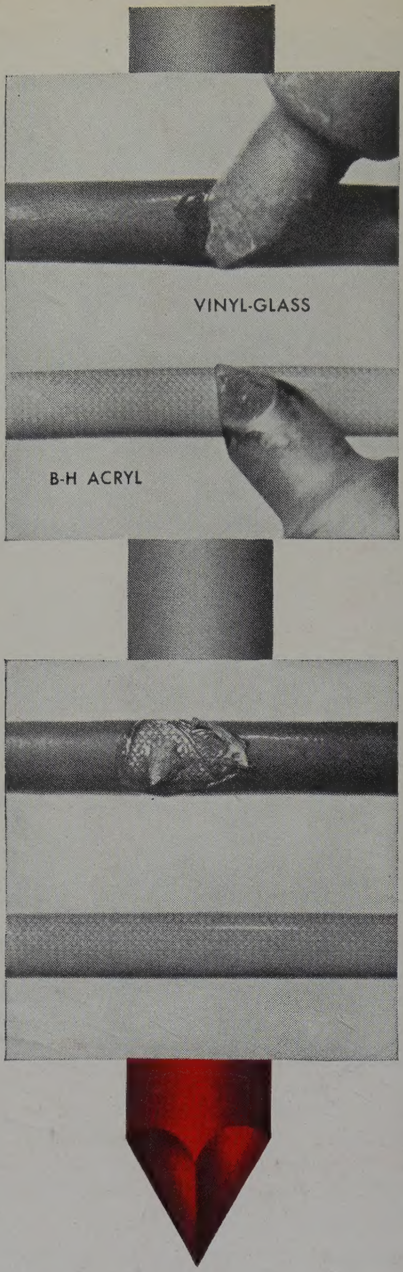

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